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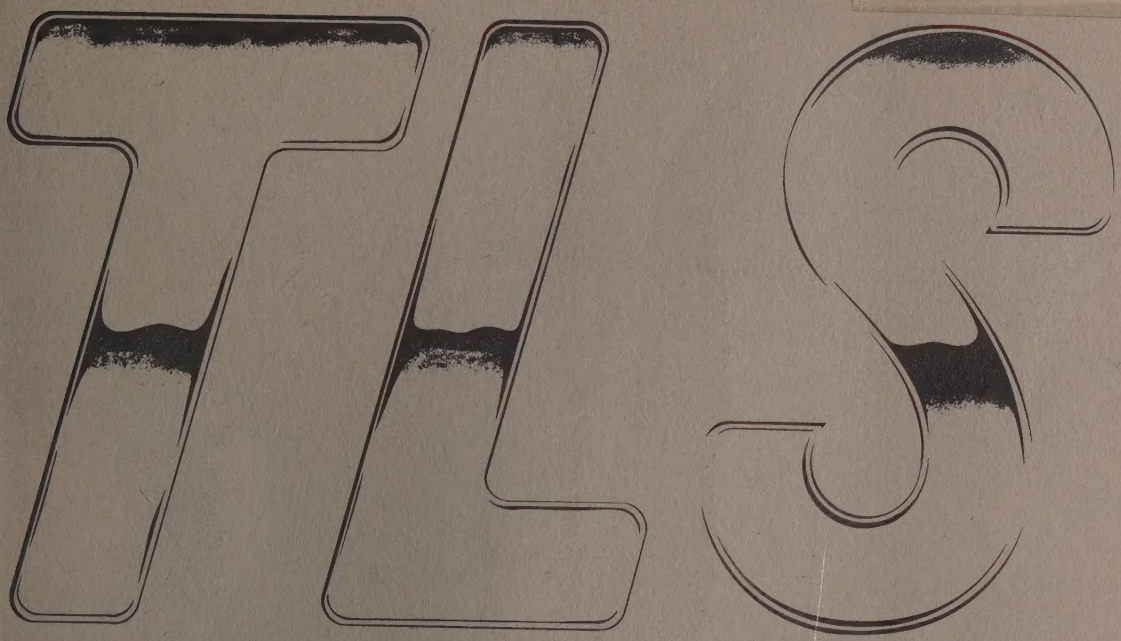
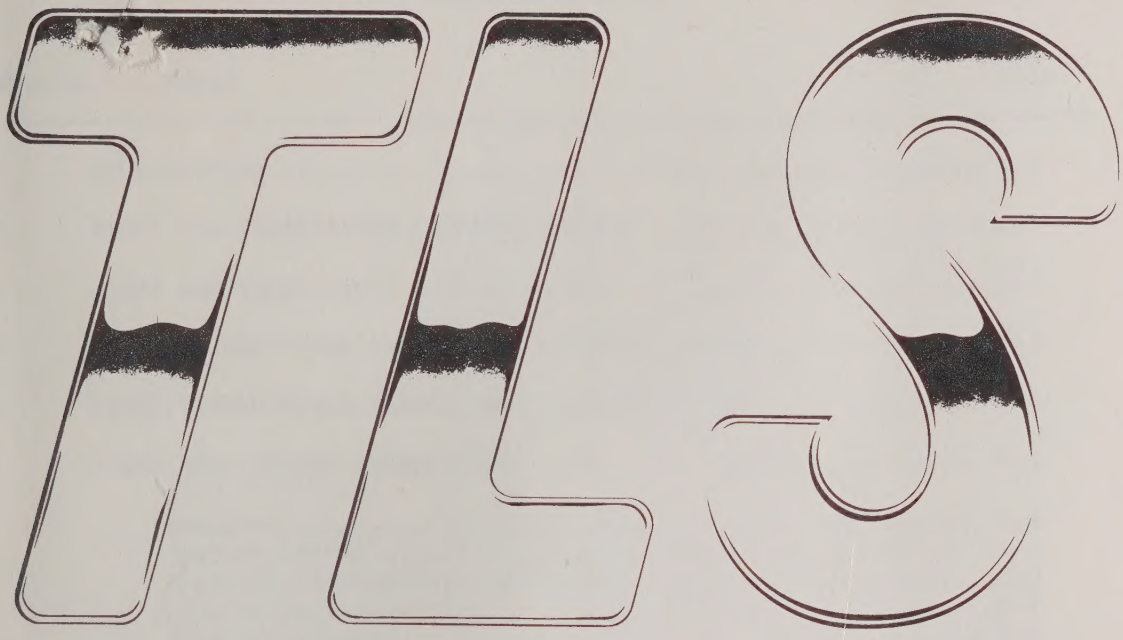


Temperature Logging Systems

User's Guide

FLUKE®



Temperature Logging Systems

User's Guide

FLUKE®

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PURPOSE AND SCOPE

The purpose of the Temperature Logging System Users Guide is to give the user an understanding of the TLS system configuration, flexibility and applications. It brings together information found in the manual sets of each instrument in the TLS family into a single source document.

This guide provides the TLS user with practical information that is useful in system configuration and set up. In addition some application and programming hints are provided. This guide is not intended to be used as a maintenance and repair or troubleshooting guide, nor should it be used as a replacement for the manual.

HOW TO USE THIS GUIDE

The TLS guide is designed to answer two basic questions.

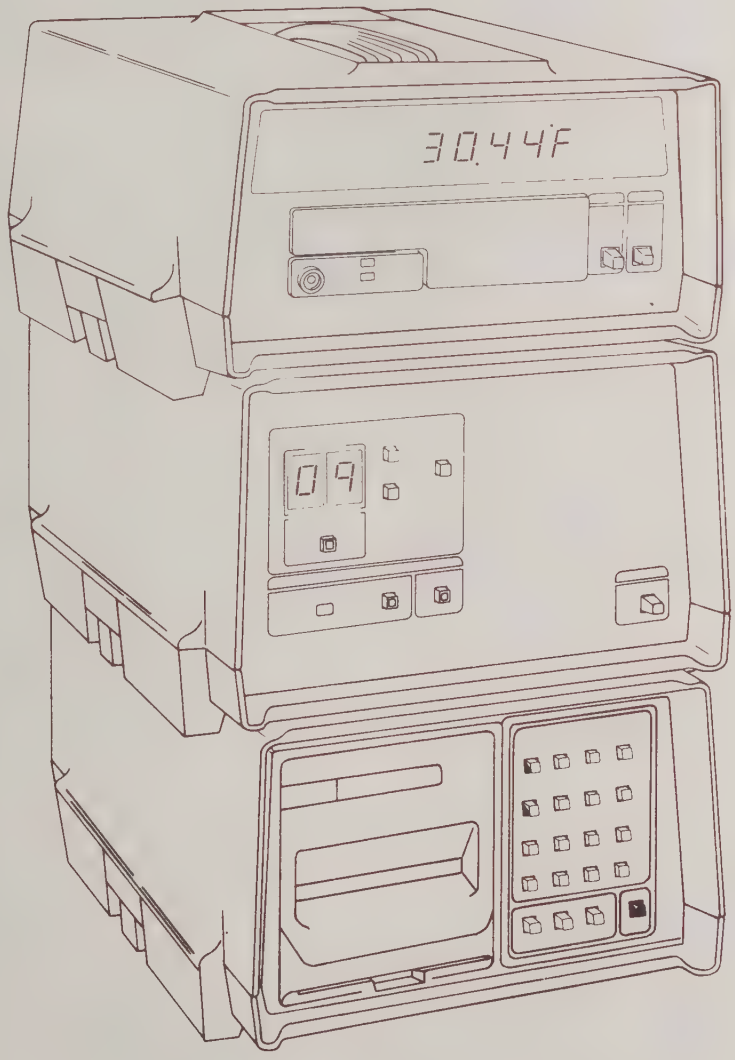
1) What instruments are needed to perform a Temperature Measurement Task.

2) How is a system configured and what switches need to be set.

The sections in this guide are arranged by instrument type. The factory configured temperature logging systems are presented first, followed by the precision thermometers, multi-channel scanners, and the logging printers. Information on the options used by each mainframe is found at the end of the appropriate mainframe section. The last two sections are "Accessories" and "System Configuration Examples."

Temperature Logging Systems

2382A
2383A
2392A
2393A



2382A RTD TEMPERATURE LOGGING SYSTEM

The 2382A RTD Temperature Logging System is a factory configured and tested, portable temperature logger consisting of a 2180A RTD Digital Thermometer, a 2300A Scanner, and a 2020A Universal Printer. All internal switches have been preset except RTD type select and channel skip select.

To set up your 2382A TLS stack for operation, perform the following procedure:

1. Familiarize yourself with the individual instrument's manual set, as well as the sections within this guide pertaining to the instruments.

2. Stack the 2300A Scanner on top of the 2020A Printer and lock the latches on the bottom of the Scanner into place on the Printer.

3. Stack the Thermometer on top of the Scanner/Printer combination and latch it into place.

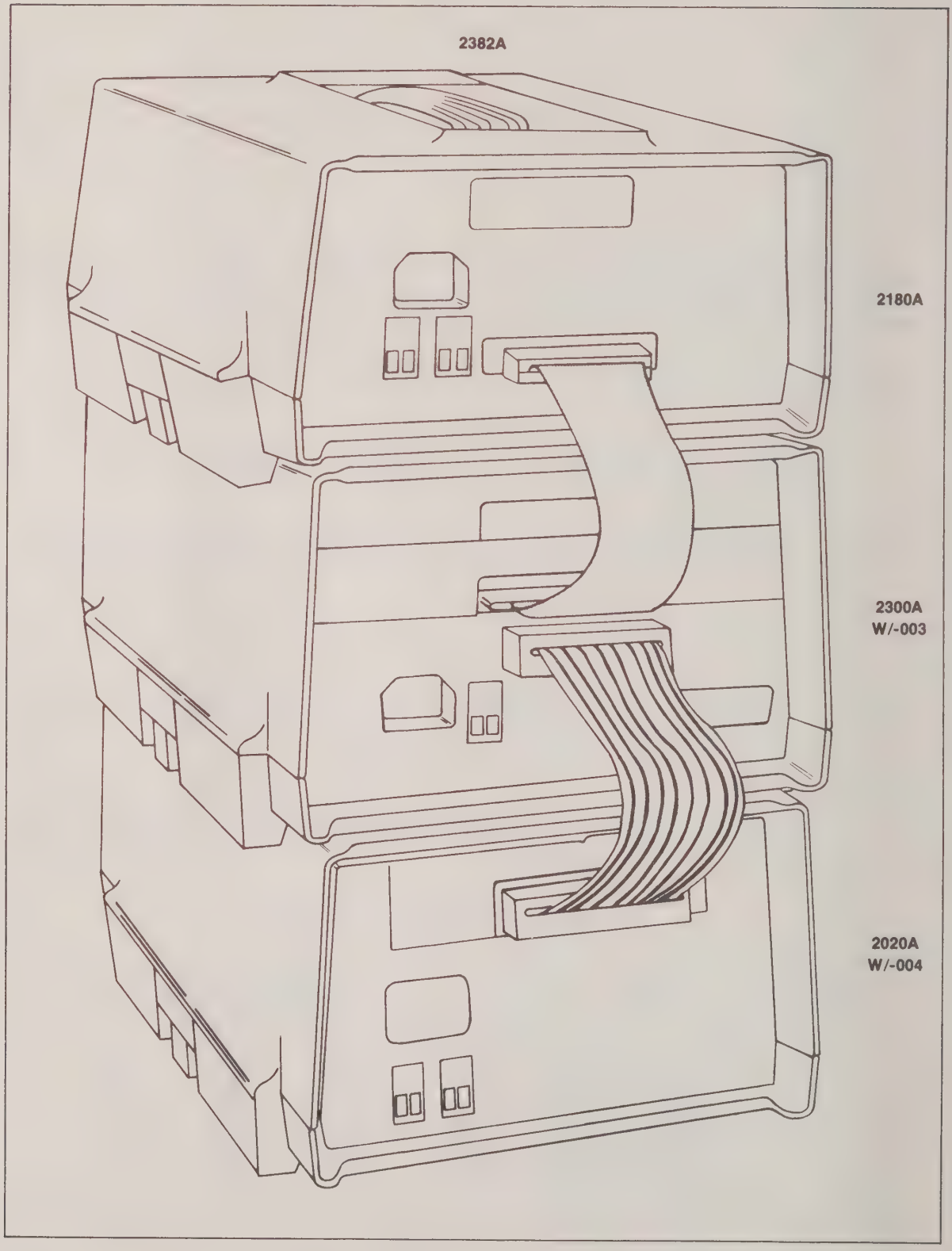
4. Attach the RTD temperature sensors to the 2300A-003 Scanner card(s), observing polarity conventions. The red wires should go V+ and S+, while the other two should go to the minus terminals. See the 2180A manual for 2 or 3-wire RTD installation.

5. Set S1 and S2 on the 2300A-003 card(s) to the proper RTD type selection codes. S1 controls the type selection for channels 0-4; S2 controls the type selection for channels 5-9. See Table 2-1 for the type selection codes.

Table 2-1. RTD Type Selection Codes

SELECTION CODE	RTD TYPE	SWITCH POSITIONS			
		1	2	3	4
0	385 Platinum	OFF	OFF	OFF	OFF
1	390 Platinum	ON	OFF	OFF	OFF
2	3916 Platinum	OFF	ON	OFF	OFF
3	392 Platinum	ON	ON	OFF	OFF
4	100 Ohm Nickel	OFF	OFF	ON	OFF
5	10 Ohm Copper	ON	OFF	ON	OFF

Figure 2-1. 2382A RTD Temperature Logging System



6. Set S3 on the 2300A-003 card(s) to skip any unused channels, if desired. (Note: ON = skipped)

7. Slide the -003 Scanner card(s) into the 2300A Scanner.

8. Connect the grey flat cable which is attached to the 2300A to the accessory connector at the rear of the 2180A Thermometer. See Figure 2-1.

9. Connect one end of the rainbow ribbon cable supplied with the TLS stack to the data I/O connector of the 2300A, and the other end to the data I/O connector of the 2020A Printer.

10. Attach the three-way power cord to all three units.

11. All other switch settings and connections are factory-set. To verify that they have not been changed, check the following switch settings: 2300A--(On the interface board at the rear of the scanner) S1 set to ON OFF ON OFF; S2 set to ON OFF OFF OFF. 2180A--(On the RTD input module) S2 set to AUTO; S3 set to MAN.

12. See the individual instrument's manual for specific programming instructions.

Notes:

As the 2020A Printer controls the scan rate of the Scanner, the 2300A Scanner will not scan with the printer ON unless the printer is actively logging data.

If at any time the user wishes to use any of the three instruments separately or in another configuration, then he/she may do so. See Case 3A given in Section 18 of this guide for instructions on re-configuring the TLS stack.

2383A RTD TEMPERATURE LOGGING SYSTEM

The 2383A RTD Temperature Logging System is a factory configured and tested, portable temperature logger consisting of a 2180A Digital RTD Thermometer, a 2300A Scanner, and a 2030A Printer. All of the internal switches have been preset except the RTD type select and channel skip select.

To set up your 2383A TLS stack for operation, perform the following procedure:

1. Familiarize yourself with the individual instrument's manual set, as well as the sections within this guide pertaining to the instruments.

2. Stack the 2300A Scanner on top of the 2030A Printer and lock the latches on the bottom of the Scanner into place on the Printer.

3. Stack the Thermometer on top of the Scanner/Printer combination and latch it into place.

4. Attach the temperature sensors to the 2300A-003 RTD/OHMS Scanner card(s), observing polarity conventions. The red wires should go to V+ and S+, while the other two wire should go to the negative terminals. See the 2180A manual for information on connecting 2 and 3-wire RTD's.

5. Set S1 and S2 on the 2300A-003 card(s) to the proper RTD type selection codes. S1 controls the type selection for channels 0-4; S2 controls the type selection for channels 5-9. See Table 2-1 for the type selection codes.

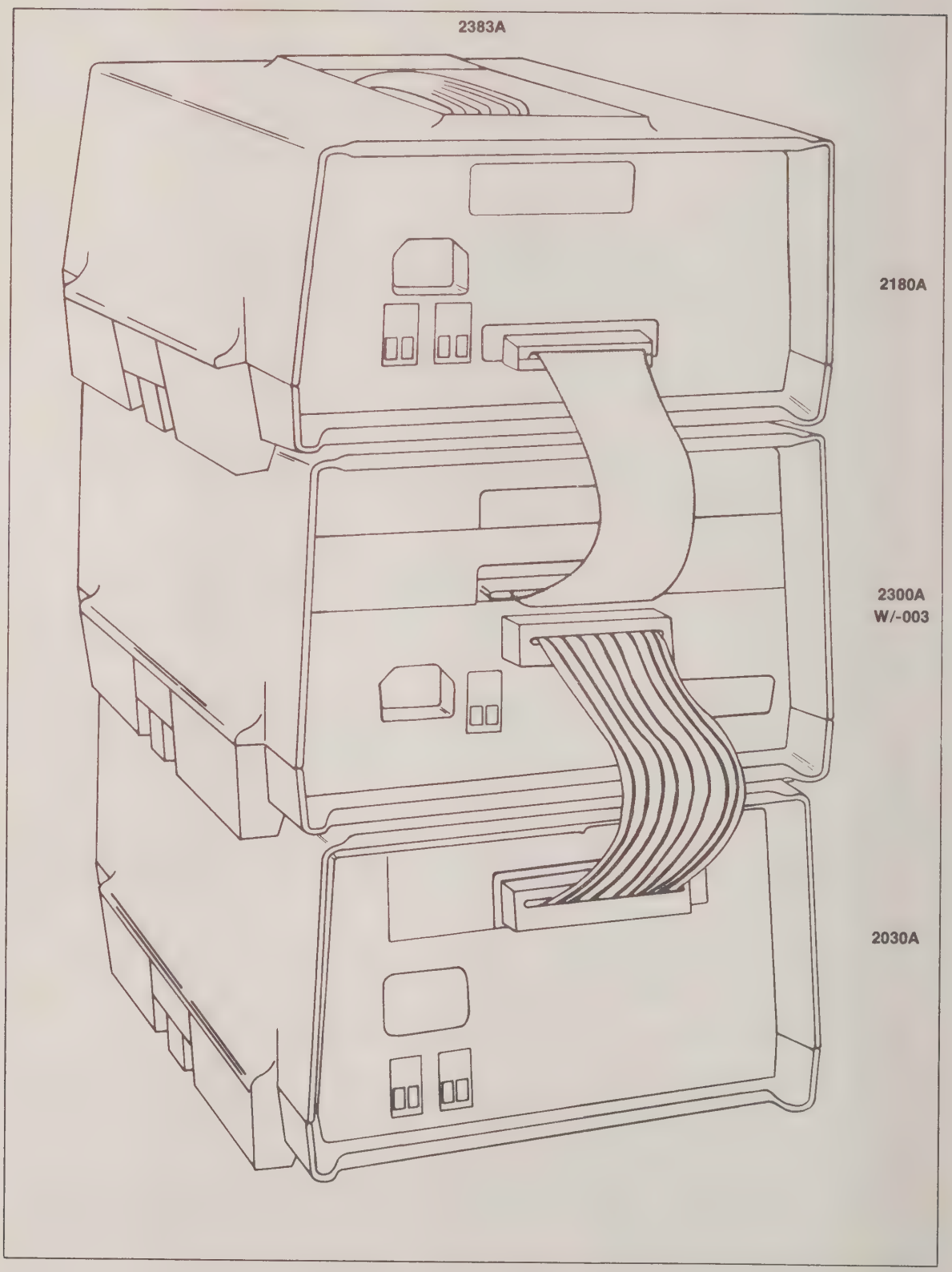
6. Set S3 on the 2300A-003 card(s) to skip any unused channels, if desired. (Note: ON = skipped)

7. Slide the Scanner cards into the 2300A Scanner.

8. Connect the grey flat cable which is attached to the 2300A to the accessory connector at the rear of the 2180A Thermometer. See Figure 3-1.

9. Connect one end of the rainbow ribbon cable supplied with the TLS stack to the data I/O connector of the 2300A, and the other end to The data I/O connector of the 2030A Printer. See Figure 3-1.

Figure 3-1. 2383A RTD Temperature Logging System



10. Attach the three-way power cord to all three units.

11. All other switch settings and connections are factory-set. To verify that they have not been changed, check the following switch settings: 2300A--(On the interface board at the rear of the Scanner) S1 set to ON OFF ON OFF; S2 set to ON OFF OFF OFF. 2180A--(On the RTD input module) S2 set to AUTO; S3 set to MAN.

12. See the individual instrument's manual for specific programming instructions.

Notes:

As the printer controls the scan rate of the scanner, the 2300A Scanner will not scan with the printer ON unless the printer is actively logging data.

If at any time the user wishes to use any of the three instruments separately or in another configuration, then he/she may do so. See Case 3B given in Section 18 of this guide for instructions on re-configuring the TLS stack.

2392A THERMOCOUPLE TEMPERATURE LOGGING SYSTEM

The 2392A Thermocouple Temperature Logging System is a factory configured and tested, portable temperature logger consisting of a 2190A Thermocouple Digital Thermometer, a 2300A Scanner, and a 2020A Printer. All internal switches have been preset except the thermocouple type select and the channel skip select.

To set up your 2392A TLS stack for operation, perform the following procedure:

1. Familiarize yourself with the individual instrument's manual set, as well as the sections within this guide pertaining to the instruments.

2. Stack the 2300A Scanner on top of the Printer and lock the latches on the bottom of the Scanner into place on the 2020A Printer.

3. Stack the Thermometer on top of the Scanner/Printer combination and latch it into place.

4. Attach the thermocouple temperature sensors to the 2300A-002 Scanner card(s), observing polarity conventions. The red thermocouple wire should be attached to the negative terminal of the isothermal block.

5. Set S1 and S2 on the 2300A-002 card(s) to the proper type selection codes. S1 controls the type selection for channels 0-4; S2 controls the type selection for channels 5-9. See Table 4-1 for the type selection codes.

6. Set S3 on the 2300A-002 card(s) to skip any unused channels, if desired. (Note: ON = skipped)

7. Slide the Scanner cards into the 2300A Scanner.

8. Connect the grey flat cable which is attached to the 2300A to the accessory connector at the rear of the 2190A Thermometer. See Figure 4-1.

9. Connect one end of the rainbow ribbon cable supplied with the TLS stack to the data I/O connector of the 2300A, and the other end to the data I/O connector of the 2020A Printer. See Figure 4-1.

Figure 4-1. 2392A Thermocouple Temperature Logging System

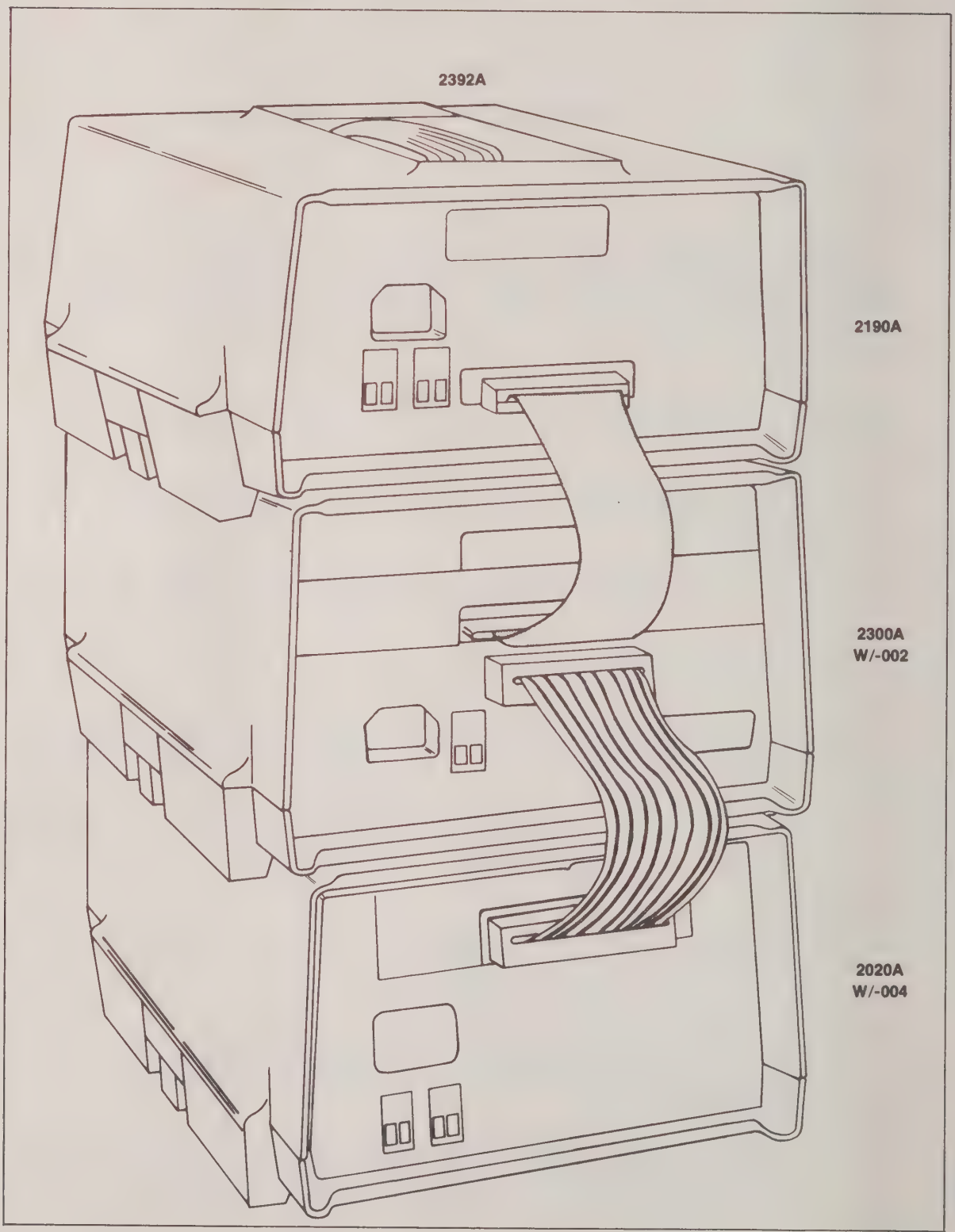


Table 4-1. Thermocouple Type Selection Codes

SELECTION CODE	SWITCH POSITIONS				u/P TYPE	u/P TYPE	u/P TYPE
	1	2	3	4	1	2	3
0	OFF	OFF	OFF	OFF	J	J	JDIN
1	ON	OFF	OFF	OFF	K	K	K
2	OFF	ON	OFF	OFF	T	-	TDIN
3	ON	ON	OFF	OFF	-	E	-
4	OFF	OFF	ON	OFF	C	-	B
5	ON	OFF	ON	OFF	-	S	-
6	OFF	ON	ON	OFF	R	R	R
7	ON	ON	ON	OFF	-	-	-
8	OFF	OFF	OFF	ON	CAL	CAL	CAL
9	ON	OFF	OFF	ON	CAL	CAL	CAL

10. Attach the three-way power cord to all three units.

11. All other switch settings and connections are factory-set. To verify that they have not been changed, check the following switch settings: 2300A--(On the interface board at the rear of the Scanner) S1 set to ON OFF ON OFF; S2 set to ON OFF OFF OFF.

12. See the individual instrument's manual for specific programming instructions.

Notes:

As the printer controls the scan rate of the scanner, the 2300A Scanner will not scan with the printer ON unless the printer is actively logging data.

If at any time the user wishes to use any of the three instruments separately or in another configuration, then he/she may do so. See Case 3A given in Section 18 of this guide for instructions on re-configuring the TLS stack.

2393A THERMOCOUPLE TEMPERATURE LOGGING SYSTEM

The 2393A Thermocouple Temperature Logging System is a factory configured and tested, portable temperature logger consisting of a 2190A Thermocouple Digital Thermometer, a 2300A Scanner, and a 2030A Printer. All internal switches have been preset except the thermocouple type select and the channel skip select.

To set up your 2393A TLS stack for operation, perform the following procedure:

1. Familiarize yourself with the individual instrument's manual set, as well as the sections within this guide pertaining to the instruments.

2. Stack the 2300A Scanner on top of the 2030A Printer and lock the latches on the bottom of the Scanner into place on the Printer.

3. Stack the Thermometer on top of the Scanner/Printer combination and latch it into place.

4. Attach the thermocouple temperature sensors to the 2300A-002 Scanner card(s), observing polarity conventions. The red thermocouple wire should go to the negative terminal on the isothermal block.

5. Set S1 and S2 on the 2300A-002 card(s) to the proper thermocouple type selection codes. S1 controls the type selection for channels 0-4; S2 controls the type selection for channels 5-9. See Table 4-1 for the type selection codes.

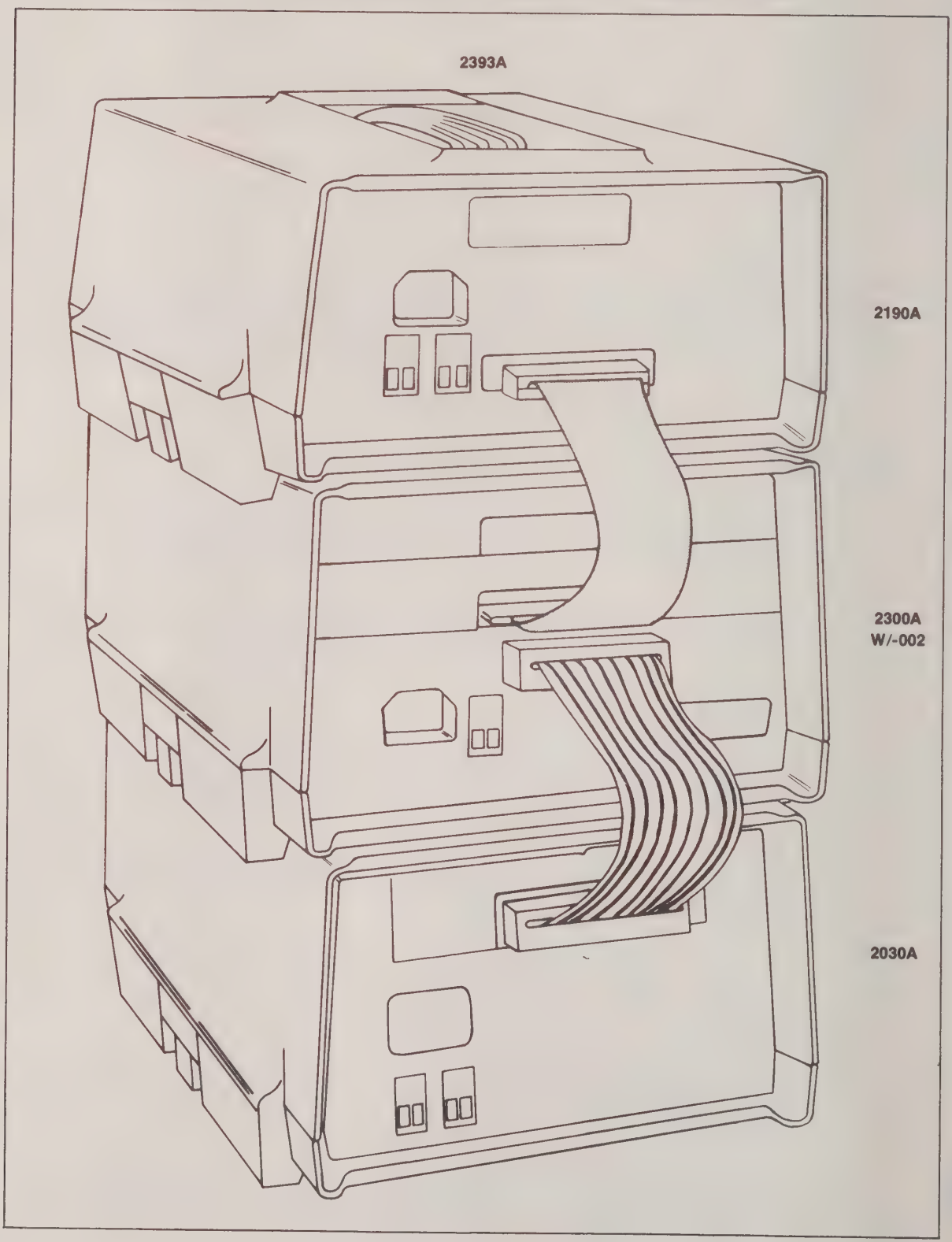
6. Set S3 on the 2300A-002 card(s) to skip any unused channels, if desired. (Note: ON = skipped)

7. Slide the Scanner cards into the 2300A Scanner.

8. Connect the grey flat cable which is attached to the 2300A to the accessory connector at the rear of the 2190A Thermometer. See Figure 5-1.

9. Connect one end of the rainbow ribbon cable supplied with the TLS stack to the data I/O connector of the 2300A, and the other end to the data I/O connector of the 2030A Printer. See Figure 5-1.

Figure 5-1. 2393A Thermocouple Temperature Logging System



10. Attach the three-way power cord to all three units.

11. All other switch settings and connections are factory-set. To verify that they have not been changed, check the following switch settings: 2300A--(On the interface board at the rear of the Scanner) S1 set to ON OFF ON OFF; S2 set to ON OFF OFF OFF.

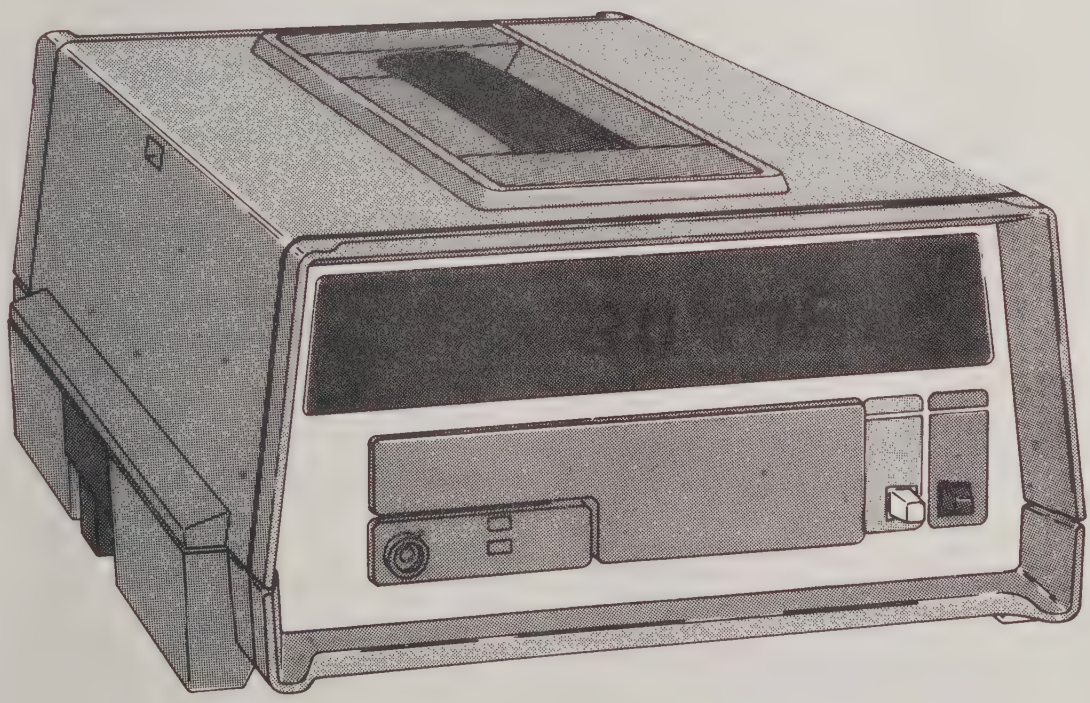
12. See the individual instrument's manual for specific programming instructions.

Notes:

As the printer controls the scan rate of the scanner, the 2300A Scanner will not scan with the printer ON unless the printer is actively logging data.

If at any time the user wishes to use any of the three instruments separately or in another configuration, then he/she may do so. See Case 3B given in Section 18 of this guide for instructions on re-configuring the TLS stack.

2180A
Digital RTD
Thermometer



2180A RTD DIGITAL THERMOMETER

FEATURES

- 0.1° or 0.01° resolution, depending on range
- Pushbutton $^{\circ}C/^{\circ}F$ temperature scale select
- 5 RTD types: 3 Pt, 1 Ni, 1 Cu
- Can also measure ohms, uV

GENERAL SPECIFICATIONS:

See Table 6-2 for 2180A Total Instrument Accuracy Specifications.

Operating Power
12V dc or 100, 120, 220, 240V ac ± 10%, selectable 50 to 400 Hz; 8W typical, 14W max.

Warm-up to Rated Accuracy
5 minutes

Input Connection
4-wire to screw terminal block

Input Impedance
1000 Mohms at dc

Accuracy vs Wire Length
No lead resistance error in 4-wire RTD's if R_2 adjustment on the RTD Input Module is used. Otherwise, $0.04^{\circ}C$/ohm resistance of any one input lead if R_2 is not adjusted.

Display
$^{\circ}F$ or $^{\circ}C$, switch-selectable, 7-segment LED's 1.1 cm high.

Resolution
0.01° below $204^{\circ}C$ for platinum RTD's, automatically shifting to 0.1° above $204^{\circ}C$ ($93^{\circ}C$ for nickel RTD's). If readings are decreasing, shift is at $77^{\circ}C$ for platinum, $66^{\circ}C$ for nickel.

RTD Excitation Current

Nominal 0.5 mA

Specifications, Cont.

Common Mode Voltage

350 Vdc, 250 Vac rms, max

Normal Mode Rejection

≥90 dB at dc, 50 60, and 400 Hz ±0.1%

Response Time

1 second typical

Zero Drift

Automatic zero correction

RTD Types

100 ohm 385 Pt (DIN), 390 Pt, 3916 Pt, 392 Pt; 100 ohm Ni (DIN), 10 ohm Cu, or 0 to 1000 ohm resistance, selectable via switch located on the input module.

Voltage Range (Calibration Only)

No annunciator or decimal point. 99,999 uV full scale (switch S2 in AUTO), resolution 1uV; 999,999 uV full scale (switch S2 in .1), resolution 10uV.

Table 6-1. IPTS 68 Coefficients
(For Microcomputer Type #2 Curve Fit Linearizations)

RTD TYPE	RTD LINEARIZATION COEFFICIENTS
100 ohm 385 Pt	DIN 43760 Table
100 ohm 390 Pt	Alpha - 0.0038994 Delta - 1.494 A4 = -0.265668 X 10^{-4} C4 = -0.205984 X 10^{-11}

Table 6-1. IPTS 68 Coefficients Cont.
(For Microcomputer Type #2 Curve Fit Linearizations)

RTD TYPE	RTD LINEARIZATION COEFFICIENTS
100 ohm 3916 Pt	Alpha = 0.003916 Delta = 1.505 A4 = -.099668 X 10^{-5} C4 = -0.271142 X 10^{-12}
100 ohm 392 Pt	Alpha = 0.0039221 Delta = 1.493 A4 = -0.38668 X 10^{-5} C4 = -0.192912 X 10^{-13}
100 ohm 617 Ni	Alpha = 0.00617
10 ohm Cu	R_0 = 9.042 ohm R_{25} = 10.005 ohm Alpha = .004260

2180A CONTROLS, INDICATORS, AND CONNECTORS

See Figure 6-1 and Table 6-3 for a description of the 2180A's controls, indicators, and connectors locations and functions.

Table 6-2. 2180A RTD Total Instrument Accuracy Specifications

RTD TYPE	RESOLUTION	TEMPERATURE RANGE APPLICABLE PORTION OF °C	TEMPERATURE RANGE APPLICABLE PORTION OF °F	MAXIMUM ERROR* ±DEGREES C AT CAL	±DEGREES C 90 DAYS 20° to 30°	±DEGREES C 1 YR. 15° to 35°	±DEGREES F AT CAL	±DEGREES F 90 DAYS 68° to 86°	±DEGREES F 1 YR. 59° to 95°
100 ohm	.01°	-190 to 0	-309 to 32	.043	.089	.112	.076	.161	.203
		0 to 204	32 to 399.2	.043	.132	.173	.076	.239	.314
385 Pt	.1°	-190 to 0	-309 to 32	.11	.12	.14	.18	.21	.24
		0 to 750	32 to 1382.0	.11	.26	.37	.18	.46	.62
100 ohm	.01°	-200 to 0	-327.9 to 32	.009	.055	.078	.015	.100	.142
		0 to 204	32 to 399.2	.009	.098	.139	.015	.177	.252
390 Pt	.1°	-200 to 0	-327.9 to 32	.08	.10	.11	.13	.16	.19
		0 to 750	32 to 1382.2	.08	.23.	.32	.13	.41	.57
100 ohm	.01°	-200 to 0	-327.9 to 32	.040	.086	.109	.071	.156	.198
		0 to 204	32 to 399.2	.040	.13	.171	.071	.234	.309
3916 Pt	.1°	-200 to 0	-327.9 to 32	.11	.12	.14	.17	.21	.24
		0 to 750	32 to 1382.2	.10	.26	.34	.17	.46	.62
100 ohm	.01°	-200 to 0	-327.9 to 32	.008	.055	.078	.014	.099	.141
		0 to 204	32 to 399.2	.009	.098	.139	.014	.177	.252
392 Pt	.1°	-200 to 0	-327.9 to 32	.08	.10	.11	.12	.16	.19
		0 to 750	32 to 1382.2	.08	.23	.32	.12	.41	.57
100 ohm	.01°	-60 to 0	-76 to 32	.129	.157	.172	.230	.282	.308
		0 to 93	32 to 199.4	.129	.176	.199	.231	.217	.359
617 Ni	.1°	-60 to 0	-76 to 32	.19	.20	.21	.33	.35	.36
		0 to 177	32 to 350.6	.19	.22	.25	.33	.39	.44
10 ohm CU	.01°	N/A							
	.1°	-75 to 0	-103 to 32	.16	.18	.19	.27	.31	.34
		-75 to 150	-103 to 302	.16	.20	.23	.27	.35	.41
OHMS		0 to 196.99	.005	.042	.059	<---ALL UNITS IN OHMS			
		0 to 999.99	.05	.22	.31				

* Maximum error depends on the temperature measured and the resolution used. Of the four temperature ranges presented for each RTD, the first two represent .01° resolution. The above maximum error numbers represent instrument errors only, and do not include the RTD probe.

Figure 6-1. Controls, Indicators, and Connectors.

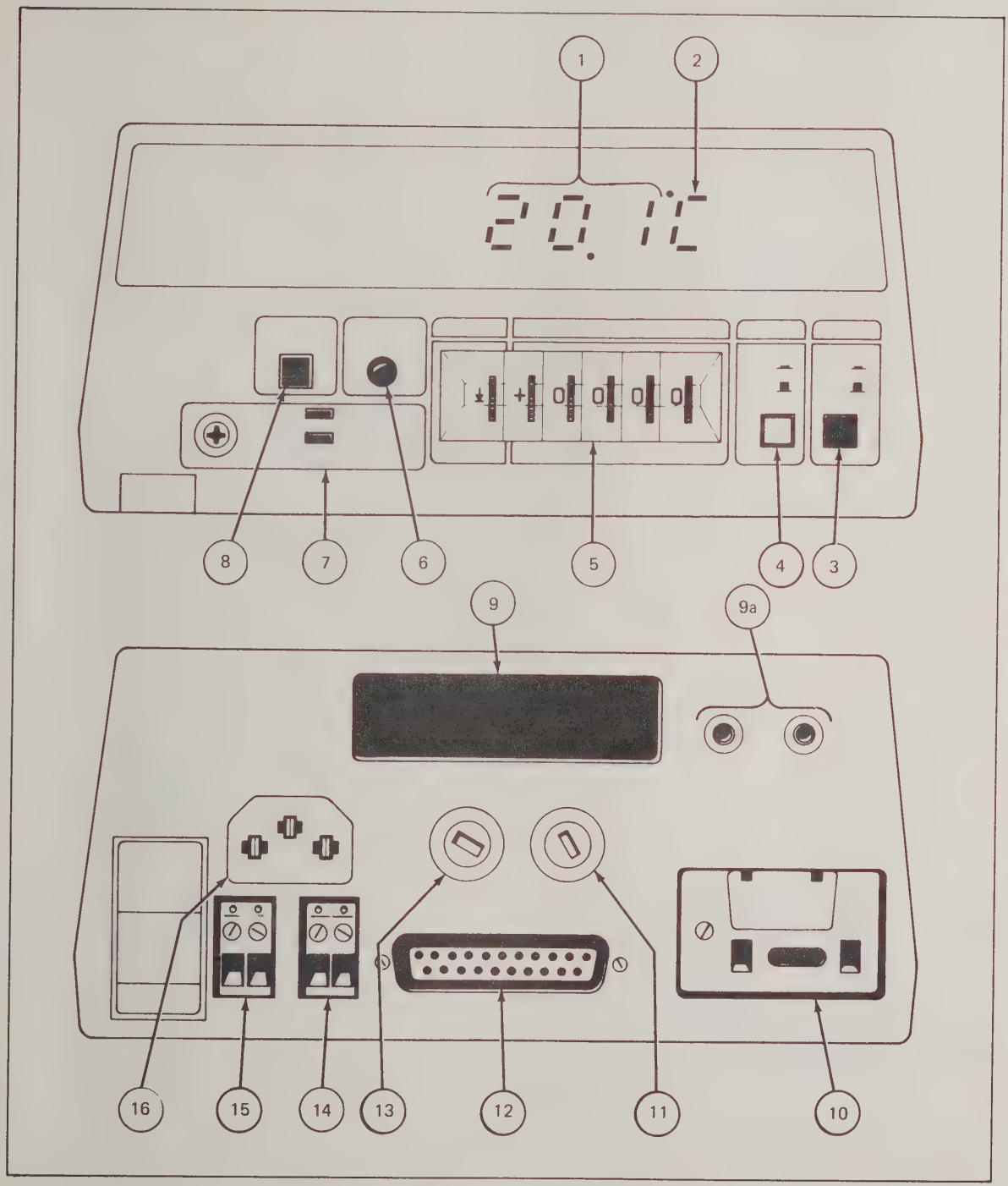


Table 6-3. Controls, Indicators, and Connectors

REF	NAME	FUNCTION
1	DIGITAL DISPLAY	Displays a five digit readout of the measured input temperature. Leading zero suppression and a variable position decimal point are included. A minus sign is displayed for negative temperature measurements. Flashes when overranged.
2	TEMPERATURE SCALE INDICATOR	Displays the temperature scale represented by the digital display data: °C or °F.
3	POWER SWITCH	Push on/Push off.
4	SCALE	Selects the temperature scale for display: °C or °F.
5	LIMIT AND FUNCTION	Part of the -006 Limits Option. When installed, the thumbwheels may be set to a four digit LIMIT value (+ or -). The FUNCTION thumbwheel can then be set to define the limit value and signal (LIMIT EXCEEDED) when the displayed temperature has exceeded the limit value(>,≤). Display will read the difference between the thumbwheel setting and the actual temperature when △ is set in FUNCTION. Set FUNCTION thumbwheel for storage of maximum ⊤ or minimum ⊥ measured since last initializing (no limit value settings necessary).
8	LIMIT EXCEEDED	Part of the -006 Limits Option. Resets the previous maximum and minimum readings stored by the microcomputer.
9	DIGITAL OUTPUT	Connector for the ASCII coded data for the Output Unit, if Option -002 is installed.
9a	ANALOG OUTPUT	Banana jack connector for an Analog Output (1 mV per degree), if Option -002 is installed.
10	RTD INPUT MODULE	Removable module houses RTD input connections and type selection switch.

Table 6-3. Controls, Indicators, and Connectors, Cont.

11	F2	External 12V dc input fuse (3/4A MDL slo-blo).
12	ACCESSORY CONNECTOR	Cable connector for accessory bus connection from accessory units.
13	F1	Input line power fuse 1/8A (100 or 120V ac) 1/16A (220 or 240V ac). MDL (slo-blo).
14	LIMITS	When the Limits Option is installed, it provides contact closure when the set limit has been exceeded.
15	±12VDC	Input terminals for the external 12V dc power source.
16	LINE VOLTAGE CONNECTOR	Input connector for the input line voltage.

LINE VOLTAGE SELECTION

VOLTAGE	S3 SLOT (REAR SW)	S4 SLOT (FRONT SW)
100	Left	Right
120	Left	Left
220	Right	Right
240	Right	Left

FUSE REPLACEMENT

WARNING:

DISCONNECT THE UNIT FROM LINE POWER BEFORE ATTEMPTING FUSE REPLACEMENT.

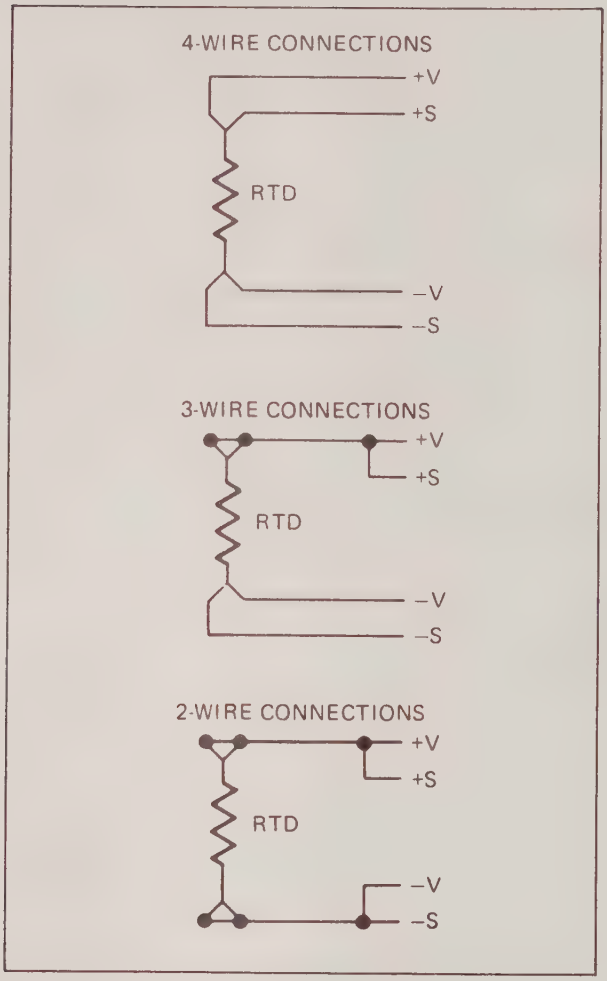
The 2180A has two fuses, both accessible on the rear panel. F1 is for the input line power and should be replaced, when necessary, with a 1/8A MDL (slo-blo) fuse when the input line power selected is 100V or 120V. When the input power selected is 220V or 240V, F1 should be replaced with a 1/16A MDL fuse. F2 is for the 12V dc external power and requires a 3/4A MDL fuse.

OPERATION

RTD CONNECTIONS

Refer to Figure 6-2 as an aid in making the proper RTD connections.

Figure 6-2. RTD Connections



NOTE: When 2 or 3-wire RTD's are used, there is some error created due to the RTD excitation current in the Sense (S) leads. To minimize this error, the user should (when possible) use the 4-wire RTD connection as shown in Figure 6-2.

SWITCH SETTINGS AND ADJUSTMENTS

RTD type selection is made via the RTD input module at the rear of the unit. There are 3 switches and 1 pot.

- S1 - RTD select. See Table 6-4.
- S2 - Resolution select. See Table 6-5.
- S3 - Operating Mode. See Table 6-5.
- R2 - Compensates for probe lead resistance

Table 6-4. RTD Type Selection Codes

SELECTION CODE	RTD TYPE	SWITCH POSITIONS			
		1	2	3	4
0	385 Platinum	OFF	OFF	OFF	OFF
1	390 Platinum	ON	OFF	OFF	OFF
2	3916 Platinum	OFF	ON	OFF	OFF
3	392 Platinum	ON	ON	OFF	OFF
4	100 Ohm Nickel	OFF	OFF	ON	OFF
5	10 Ohm Copper	ON	OFF	ON	OFF
NOTE: Your RTD Input Module may be printed with microcomputer Type #1 selector switch settings. Therefore we advise that you refer to Table 6-4 when changing RTD types.					

Table 6-5. S2 and S3 Switch Settings

S2	.1	Causes the analog to digital converter circuitry (A/D) to have 10uV input sensitivity and displays temperature to 0.1° resolution only.
	AUTO	Causes the A/D to automatically change from .01° to 0.1° resolution for overrange or 0.1° to .01° resolution for underrange.
S3	Scan	Not used
	Man	MUST BE LEFT IN THIS POSITION DURING NORMAL OPERATION
NOTE: The R2 adjustment can be used to calibrate the 2180A and the probe near a specific temperature. Adjust R2 for agreement between the 2180A and a customer supplied temperature reference at the temperatures of interest.		

MEASURING VOLTAGE

The 2180A is capable of measuring voltage signals up to +100mV or +1V.

NOTE: The decimal point and temperature scale indicator ($^{o}C/^{o}F$) should be ignored during the following steps; the user must be aware of the selected range.

100 Millivolt Range

1. Attach lead wires to the RTD Input Module +V and -V connections.
2. Set RTD Input Module switches, S1 to position 9 and S2 to AUTO.
3. Replace RTD Input Module and turn 2180A on.
4. The 2180A is now ready to measure positive voltages up to +100 mV.

1 Volt Range

1. Attach lead wires to the RTD Input Module +V and -V connections. Refer to RTD Installation procedures as outlined in the 2180A manual.
2. Set RTD Input Module switches, S1 to position 9 and S2 to $.1^{o}$.
3. Replace RTD Input Module and turn the 2180A on.
4. The 2180A is now ready to measure positive voltages up to +1V.

MEASURING RESISTANCE

The 2180A can be used to measure positive resistance up to 999.9 ohms with 10 mohms resolution (RTD excitation ~0.5 mA). To set up the 2180A as a resistance measurement device, refer to the following steps.

NOTE: The temperature scale indicator ($^{o}C/^{o}F$) should be ignored during the following steps.

Resistance Measurements

1. Install lead wires to the RTD Input Module using the 4 wire RTD configuration.
2. Set RTD Input Module switches, S1 to position 8 and S2 to $.1^{o}$.
3. Connect a known resistance, less than 1 kohms, to the wires connected to the RTD Input Module, and use the following setups to compensate for lead resistance.
4. Replace RTD Input Module and turn the 2180A on.

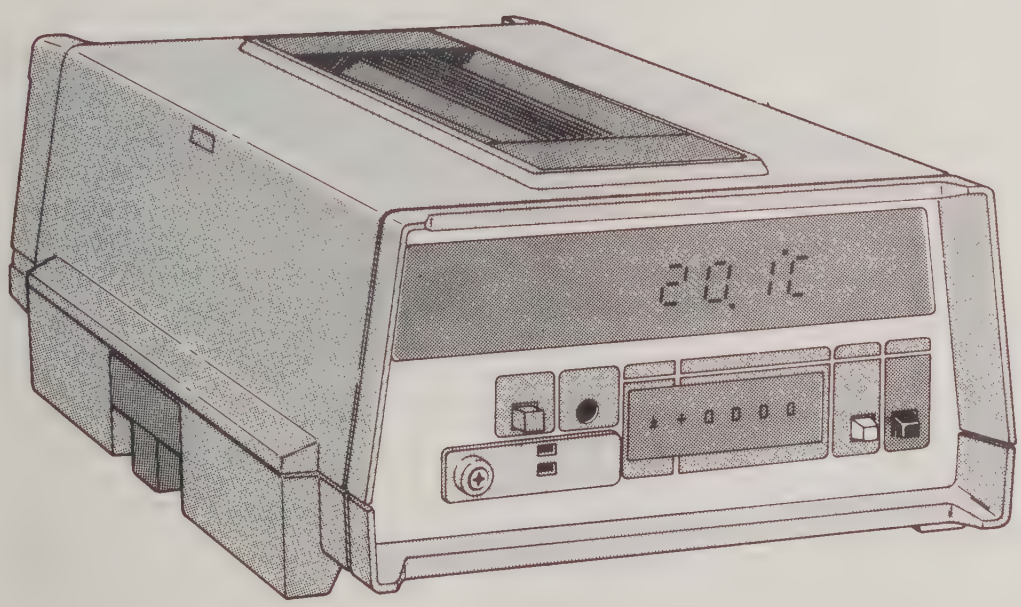
5. Adjust R2 through the rear panel of the RTD's Input Module until the 2180A's display reads the same value as the known resistance.

6. Remove the known resistance. The 2180A is now calibrated and ready to measure positive resistances up to 999.9 ohms.

NOTE: For measuring resistances of less than 196 ohms, switch S2 on the RTD Input Module should be set to the AUTO position.

NOTE: When the RTD Input Selector Switch (S1) is set for Resistance, measurements greater than 196 ohms cannot be made unless Autoranging is defeated. To do this, set S2 on the RTD Input Module for the ".1^{O}" position.

2190A
Digital Thermocouple Thermometer



2190A DIGITAL THERMOCOUPLE THERMOMETER

FEATURES

- Portable 12V dc or line operation
- ^{o}F or ^{o}C temperature scale pushbutton selectable
- 0.1^{o} resolution
- Open thermocouple detect @ 3 kohm
- Dip-switch selectable thermocouple type select

SPECIFICATIONS

There are three different 2190A microcomputer types, corresponding to the three sets of thermocouple combinations. In order to determine or verify which type the user has, turn the 2190A OFF, then ON. The reading on the display will determine the 2190A's microcomputer type.

DISPLAY AT TURN ON	uC TYPE
9004.1, or 9005.1	1
or 9005.2	2
or 9005.3	3

Thermocouple Types: Determined by microcomputer type.

MICROCOMPUTER TYPE	THERMOCOUPLE TYPES
1	J,K,T,C, and R
2	J,K,E,S, and R
3	JDIN*,K,TDIN*, B and R
*European standard	

Specifications, Cont.

Warm-Up to Rated Accuracy
5 minutes.

Input Connection
Two wires, on screw terminal isothermal block.

Input Impedance
1000 Mohm at dc.

Max. Source Impedance
2 kohm

Power
12V dc or 100, 120 220, or 240V ac ±10%, selectable, 50 to 400 Hz; 8W typical.

Overrange (Overload) Detection
The thermometer display flashes either positive full scale or negative full scale depending on the polarity of the overload (voltage).

Open Circuit Detection
A source impedance of 3 kohm or more causes the thermometer to display a flashing "O.C." An internal switch allows a user to simulate a + overload or - overload which can be used to control limits or alarms for failsafe control.

Refer to Table 7-1 for the total accuracy specifications for the 2190A.

CONTROLS, INDICATORS, AND CONNECTORS

Refer to Figure 7-1 and Table 7-2 for a description of the controls, indicators, and connectors of the 2190A.

Table 7-1. 2190A Total Instrument Accuracy.

2190A Total Instrument Accuracy Specifications

MICROCOMPUTER TYPE #1

Thermocouples		Maximum Error					
		±Degrees C			±Degrees F		
Type	Applicable Portion of Temp. Range, °C	At Cal.	90 Dys 20°C to 30°C	1 Yr 15°C to 35°C	At Cal.	90 Dys 68°F to 86°F	1 Yr 59°F to 95°F
J	-128 to 0	0.18	0.19	0.21	0.20	0.23	0.26
	0 to 900	0.18	0.31	0.36	0.20	0.47	0.58
K	-132 to 0	0.18	0.19	0.21	0.30	0.33	0.37
	0 to 1350	0.18	0.39	0.47	0.30	0.72	0.87
T	-243 to 0	0.18	0.20	0.22	0.30	0.35	0.39
	0 to 400	0.18	0.22	0.25	0.30	0.41	0.46
R	0 to 1708	0.31	0.59	0.70	0.47	1.01	1.20
C	0 to 2471	0.18	0.60	0.75	0.30	1.11	1.37

MICROCOMPUTER TYPE #2

Thermocouples		Maximum Error					
		±Degrees C			±Degrees F		
Type	Applicable Portion of Temp. Range, °C	At Cal.	90 Dys 20°C to 30°C	1 Yr 15°C to 35°C	At Cal.	90 Dys 68°F to 86°F	1 Yr 59°F to 95°F
J	-128 to 0	0.18	0.19	0.21	0.20	0.23	0.26
	0 to 900	0.18	0.31	0.36	0.20	0.47	0.58
K	-132 to 0	0.18	0.19	0.21	0.30	0.33	0.37
	0 to 1350	0.18	0.39	0.47	0.30	0.72	0.87
E	-252 to 0	0.18	0.20	0.22	0.30	0.35	0.40
	0 to 1000	0.18	0.33	0.39	0.30	0.61	0.72
R	0 to 1708	0.31	0.59	0.70	0.47	1.01	1.20
S	0 to 1685	0.22	0.50	0.60	0.38	0.92	1.10

MICROCOMPUTER TYPE #3

Thermocouples		Maximum Error					
		±Degrees C			±Degrees F		
Type	Applicable Portion of Temp. Range, °C	At Cal.	90 Dys 20°C to 30°C	1 Yr 15°C to 35°C	At Cal.	90 Dys 68°F to 86°F	1 Yr 59°F to 95°F
J DIN*	-100 to 0	0.18	0.19	0.20	0.30	0.32	0.36
	0 to 760	0.18	0.28	0.33	0.30	0.52	0.61
K	-50 to 0	0.18	0.18	0.20	0.20	0.22	0.25
	0 to 1372	0.18	0.39	0.48	0.20	0.63	0.78
T DIN*	-200 to 0	0.18	0.20	0.21	0.30	0.34	0.38
	0 to 400	0.18	0.22	0.25	0.30	0.41	0.46
B	420 to 1815	0.21	0.52	0.62	0.37	0.95	1.15
R	140 to 1700	0.18	0.46	0.56	0.20	0.74	0.93

*European Standard

Figure 7-1. Controls, Indicators, and Connectors

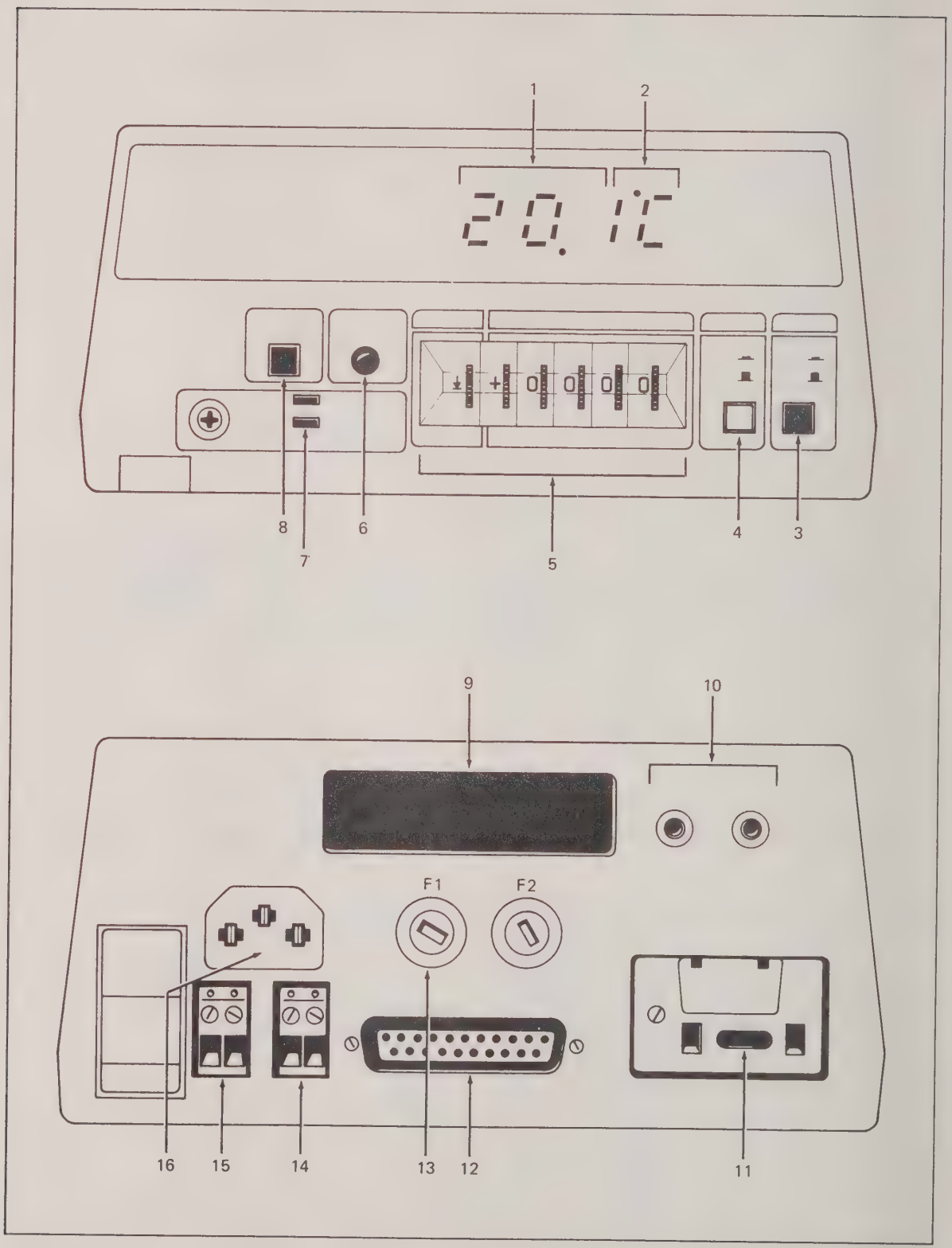


Table 7-2. Controls, Indicators, and Connectors

REF	NAME	FUNCTION
1	Digital Display	Displays a five digit readout of the measured input temperature. Leading zero suppression and a fixed decimal point are included. A minus sign is displayed for negative temperature measurement.
2	Temperature Scale Indicators	Displays the temperature scale represented by the digital display data; ^{o}C or ^{o}F.
3	Power Switch	Applies or removes power from the instrument.
4	SCALE	Selects the temperature scale for display; ^{o}C or ^{o}F.
5	LIMIT and FUNCTION	Part of the -006 Limits Option. When installed, the thumbwheels may be set to a four digit LIMIT value (+ or -). The FUNCTION thumbwheel can then be set to define the limit value and signal (LIMIT EXCEEDED) when the displayed temperature has exceeded the limit value($>,\leq$). Display will read the difference between the thumbwheel setting and the actual temperature when Δ is set in FUNCTION. Set FUNCTION thumbwheel for storage of maximum $\overline{\top}$ or minimum $\underline{\perp}$ measured since last initializing (no limit value settings necessary).
6	LIMIT EXCEEDED	Part of -006 Limits Option. Indicator illuminates when the preset limits have been exceeded.
7	CALIBRATION	Cover for calibration adjustments used in the calibration procedure.
8	INITIALIZE MAX/MIN	Part of the -006 Limits Option. Resets the accumulated maximum and minimum readings stored by the microcomputer.
9	DIGITAL OUTPUT	If Option -002 is installed, connector for the ASCII coded data for the output unit.
10	ANALOG OUTPUT	If Option -002 is installed, banana jack connector for an analog output of 1 mV per degree.

Table 7-2. Controls, Indicators, and Connectors Cont.

11	INPUT CONNECTOR	Connection and access point for Thermocouple Input Module with isothermal block for thermocouple connection and selection.
12	ACCESSORY CONNECTOR	Cable connector for electrical connection from accessory units.
13	FUSES	Fuses for the input line power (F1) and the external 12V dc input (F2).
14	LIMITS	If the Limits feature is installed, provides an output terminal for a relay contact closure to signal when the set limits have been exceeded.
15	±12 VDC	Input terminals for the external 12V dc power source.
16	LINE VOLTAGE CONNECTOR	Input connector for the input line voltage.

SWITCH SETTINGS

1. Thermocouple type-select is via dip switch S1 located on the thermocouple input module. See Table 7-3 for thermocouple type selection codes.

Table 7-3. Thermocouple Type Selection Codes

SELECTION CODE	SWITCH POSITIONS				u/P TYPE	u/P TYPE	u/P TYPE
	1	2	3	4	1	2	3
0	OFF	OFF	OFF	OFF	J	J	JDIN
1	ON	OFF	OFF	OFF	K	K	K
2	OFF	ON	OFF	OFF	T	-	TDIN
3	ON	ON	OFF	OFF	-	E	-
4	OFF	OFF	ON	OFF	C	-	B
5	ON	OFF	ON	OFF	-	S	-
6	OFF	ON	ON	OFF	R	R	R
7	ON	ON	ON	OFF	-	-	-
8	OFF	OFF	OFF	ON	*CAL	*CAL	*CAL
9	ON	OFF	OFF	ON	*CAL	*CAL	*CAL

* In these positions the display will have a maximum range of 99,999 uV with 1 uV resolution.

FUSE REPLACEMENT AND LINE VOLTAGE SETTINGS

WARNING

DISCONNECT THE UNIT FROM LINE POWER BEFORE ATTEMPTING FUSE REPLACEMENT

1. Fuse Replacement

The 2190A has two fuses, both accessible on the rear panel. F1 is for the input line power and should be replaced, when necessary, with a 1/8A MDL (slo-blo) fuse when the input line power selected is 100V or 120V. When the input power selected is 220V or 240V, F1 should be replaced with a 1/6A MDL fuse. F2 is for the 12V dc external power and requires 3/4A MDL fuse.

2. Line Voltage Settings

See Table 7-4 for a description on how to set the line voltage selection switches.

Table 7-4. Line Voltage Selection Switches Positioning

VOLTAGE	S3 SLOT (REAR SW)	S5 SLOT (FRONT SW)
100	Left	Right
120	Left	Left
220	Right	Right
240	Right	Right

Digital Thermometer Options

21X0A-002
21X0A-006

21X0A-002 OUTPUT OPTION

FEATURES

- For use with the 2180A RTD or 2190A Thermocouple Thermometers.
- Field or Factory installable.
- Analog and Digital Output simultaneously.

SPECIFICATIONS

Analog Output

Type

Linearized and isolated.

Voltage

1.0 mV/°C or °F from -425 mV to 4.5V, 5 mA max.

Accuracy

±0.1% of reading ±1 mV.

Digital Output

Types

Three, E.I.A. Standard RS-232-C Type 2*, TTY current loop, and parallel ASCII. All available simultaneously.

Connector

36-pin AMP "Champ."

Serial Baud Rates

110, 150, 300, 600, 1200, 2400, 4800, 9600, switch-selectable.

Specifications, Cont.

RS-232-C Signals*

Transmitted Data, Request to Send, Clear to Send, Data Set Ready, Signal Common.

Parallel ASCII Signals

Data 8 lines, instrument address 3 lines, Address Valid, Data Valid, Acknowledge, ground, +5V.

Parallel ASCII Data Rate

Three readings per second.

Parallel ASCII Interface

Plug-to-plug compatible with similar Fluke equipment.

TTY Current Loop Signals

Source and controlled sink, 20 mA.

Out-of-Limit Signal

Exclamation point transmitted with Option 21X0A-006 only; not with Y2002.

Battery Operation

4 to 5 hours typical at 25°C on fully charged Y2003 or Y2009.

*Standard RS-232-C signals are output on 25-pins. The connector on the -002 Output Option is 36-pins; therefore, the user must either hard wire the connection between the -002 Output Option or order the Y2026B.

OPERATION

Three switches must be set:

- S1: Baud rate select. Located in upper righthand corner of output board.
- S2: Function select. Located in upper righthand corner of output board.
- S3: Address select. Located in central portion of output board.

In order to determine the proper switch settings, see Table 8-1.

Table 8-1. Switch Selection

SWITCH	SWITCH BANK				S1	S2	S3
POSITION	1	2	3	4	BAUD RATE	FUNCTION	ADDRESS
0	OFF	OFF	OFF	OFF	110	OPERATE	ADR 0
1	ON	OFF	OFF	OFF	150	CAL 1	ADR 1
2	OFF	ON	OFF	OFF	300	CAL 2	ADR 2
3	ON	ON	OFF	OFF	600	CAL 3	ADR 3
4	OFF	OFF	ON	OFF	1200	CAL 4	ADR 4
5	ON	OFF	ON	OFF	2400	CAL 1	ADR 5
6	OFF	ON	ON	OFF	4800	CAL 2	ADR 6
7	ON	ON	ON	OFF	9600	CAL 3	ADR 7
8	OFF	OFF	OFF	ON	110	PLOT 1	ADR 8
9	ON	OFF	OFF	ON	150	PLOT 2	ADR 9

S2: For normal operation set to 0 (Cal 1, 2, 3 and 4 used in calibration of unit).

S3: Selects PTI address. When 2180A or 2190A used alone with 2020A Printer use, 1, 6, 7, 8, or 9. When used alone with 2030A Printer, use 1, 6, or, if switches S1, S2 and S3 on the 2030A are properly set, 1, 6, 7, 8, and 9.

OUTPUT CONNECTOR

Refer to Table 8-2 for listing of the output connector's pin out.

Table 8-2. Digital Output Connector Pin Out

PIN NO.	FUNCTION	MNEMONIC	USE
1	Address Valid	ADRVAL	PTI Bus
2	Data Valid	DATVAL	PTI Bus
3-6	Printer Address	A0-A3	PTI Bus
7	Acknowledge	ACK	PTI Bus
8	Not Used		
9-16	Data	D0-D7	PTI Bus
17	Ground		PTI Bus
18	+5 Volts		PTI Bus
19-24	Not Used		
30	Transmitted Data		RS-232 Interface
31	Request to send		RS-232 Interface
32	Clear to send		RS-232 Interace
33	Data set ready		RS-232 Interface
34	Signal Common		RS-232 Interface
35	S0+		Current Loop
36	S0-		Current Loop

OUTPUT FORMAT

Table 8-3. Output Format

CH	CH	SP	SP/!	SP	±	X	X	X	X	X	SP	*	*	*	*	CR	LF

SYMBOL	DESCRIPTION
CH	Channel Number
SP	Space
!	Thermometer Limits Option Setpoint exceeded symbol
±	Plus or minus symbol
XXXXXX	Thermometer displayed value including decimal point
****	Temperature units in degrees C or F and error conditions (OR for over range, OC for open thermocouple or open circuit) either;

SP	°	F/C	SP	or	°	F/C	O	R/C

NOTE

This nineteen character ASCII coded message is sent as: ASCII parallel, RS232C, and Current Loop.

* Each block represents one ASCII character. The parity bit is always sent as zero.

CONFIGURATION

NOTE: When 2180A or 2190A used with either 2030A printer or 2020A and -004, use Y7203 as mating cable assembly.

21X0A-006 LIMITS OPTION

FEATURES

- Use with either the 2180A Digital RTD thermometer or the 2190A Digital Thermocouple thermometer
- 3 functions: High/Low Limits, Delta, Min/Max Display

SPECIFICATIONS

High/Low Limits Function

Lights LED and activates form A (SPST) relay when a preset limit is exceeded. Contacts rated at 10 VA, 184V dc or 130V ac rms max, 0.5A max, resistive.

Min/Max Function

Store min or max readings, resettable from front panel.

Delta Temperature Function

Reads ± temperature deviations from preset nominal temperature.

Installable

Factory or field, through pre-punched front panel.

Function:	Limit:
≤ Low Limit	-9999°
> High Limit	+9999°
⊥ Store min reading	Not used
⊤ Store max reading	Not used
△± Deviation from	Nominal

Installation of the Limits Option enables the low current single contact relay (K1) on the thermometer Main PCB. The contact points are available on a rear panel connector block.

NOTE: Once installed there are no provisions for disabling the Limits Option. If a temperature display is desired without the relay or LED indications select one of the Limits Function (> or ≤) and the maximum or minimum setting on the numeric thumbwheel switches.

2189A
Precision
Thermometry System

2189A THERMOMETRY SYSTEM

DESCRIPTION

The 2189A Thermometry System consists of a 2180A Digital Thermometer (with microcomputer Type 2) and a Y2039 Resistance .emperature Probe which have been matched at the factory. Manufacturers of RTD probes usually specify a nominal value for the RTD probe resistance at 0°C. The actual resistance value of a specific RTD probe at 0°C can differ from the nominal value by an amount equivalent to 0.25°C or more.

The 2180A is designed so that it can be adjusted to compensate for variations in RTD resistances at 0°C. The 2180A thermometer in each 2189A Thermometry System has been adjusted at the factory to match the specific 0°C resistance value of the Y2039 RTD probe in the system.

ACCURACY SPECIFICATIONS

Table 9-1. Low Temperature Range

TEMPERATURE RANGE -183 TO +204°, RESOLUTION .01° OR °F			
TEMPERATURE °C (1)	MAXIMUM SYSTEM ERROR ± DEGREES C		
	AT CALIBRATION (2)	90 DAYS 18° to 28°C AMBIENT (2)	1 YEAR 18° to 28°C AMBIENT (2)
-183			
-50	.04	.08	.11
0	.03	.07	.09
50	.05	.10	.13
100	.07	.12	.16
150	.08	.15	.20
200	.09	.17	.23

(1) Interpolation should be used for accuracies at intermediate temperatures.

(2) The system operates down to -183°C but the probe calibration is not verified below -50°C. It is estimated that the accuracy below -50°C is the same as the accuracy at an equal temperature in the positive range.

Table 9-2. High Temperature Range - Periodic Probe Exposure (1) (3)

TEMPERATURE RANGE 204 TO +480°C, RESOLUTION 0.1°C OR °F			
MAXIMUM SYSTEM ERROR ± DEGREES C			
TEMPERATURE °C (2)	AT CALIBRATION	90 DAYS 18°C to 28°C AMBIENT	1 YEAR 18°C to 28°C AMBIENT
204	.14	.25	.27
300	.18	.32	.33
400	.21	.39	.40
480	.29	.48	.50

(1) Exposure of the Y2039 to high temperature for long periods of time may cause the probe to change its characteristics and require that the accuracy specifications to be degraded. For example, there is a 20% probability that exposure at 480°C for 500 hours will require degrading. It is easy for the user to determine if degrading is necessary by measuring the ice point resistance of the probe. Section four of the 2189A Instruction Sheet explains this procedure.

(2) Interpolation should be used for accuracies at intermediate temperatures.

(3) The accuracies in the high temperature range are based on the user performing an ice point adjustment in accordance with the following schedule.

Probe Exposure Temperature Range	Total Exposure Time Before Adjustment
200 - 350°C	500 hours
350°C - 480°C	250 hours

NOTE: For further instrument specifications, see the specifications for the 2180A and the Y2039.

SWITCH POSITIONS - RTD TYPE SELECT

Table 9-3. RTD Input Module Switch Settings

Position	RTD TYPE	S1 Switch Position			
		1	2	4	8
3	392	1	1	0	0

See Table 9-4 for IPTS 68 Coefficients used in the 2189A RTD linearization.

Table 9-4. 2180A RTD LINEARIZATION, MICROCOMPUTER TYPE 2

RTD TYPE	IPTS 68 COEFFICIENTS
Platinum 100 ohm 392	α alpha = 0.0039221 δ delta = 1.493 A4 = -0.38668×10^{-5} C4 = 0.192912×10^{-13}

2189A SYSTEM ACCURACY VERIFICATION

The 2189A System Accuracy Specifications are based on a curve conformity between the Y2039 RTD Probe and the 2180A Digital Thermometer of ±0.03% of temperature. This curve conformity can change if the Y2039 RTD Probe is exposed to high temperatures for long periods of time. For this reason, the 2189A accuracy specifications should be verified if the Y2039 RTD Probe has been recalibrated as a result of exposure to high temperatures.

The 2189A System Specifications are verified by computing the curve conformity between the 2180A Digital Thermometer and Y2039 RTD Probe. This curve conformity is calculated using equation (1) to determine ΔT. If the value for ΔT calculated using Equation 1 and the constants obtained from the Y2039 calibration report exceeds the sum of ΔT from Table 9-5 plus the uncertainty of the RTD calibration at T, then the 2189A System Accuracy should be degraded by the amount of the excess.

Table 9-5. 2180A/Y2039 Curve Conformity

TEMPERATURE T	CURVE CONFORMITY TOLERANCE $\Delta T(1)$
0	0
100	$\pm.03^{\circ}C$
200	$\pm.06^{\circ}C$
300	$\pm.09^{\circ}C$
400	$\pm.12^{\circ}C$
480	$\pm.19^{\circ}C$

Eqn (1)

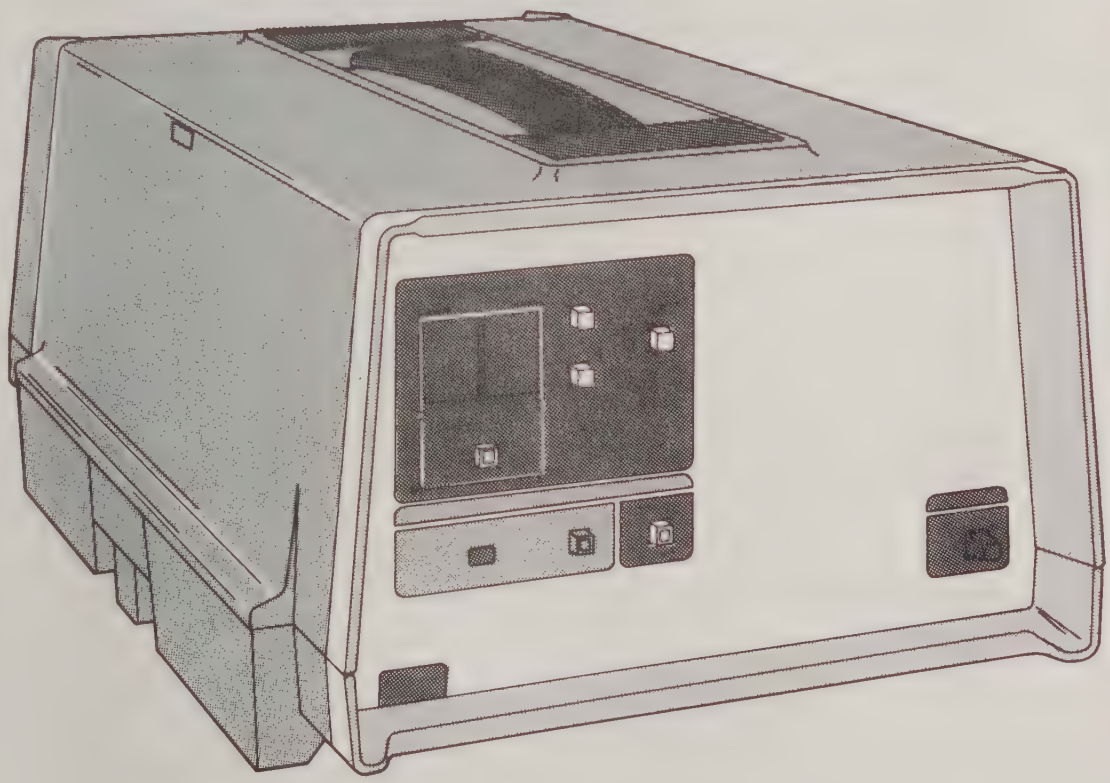
$$\Delta T = \frac{(0.00398066-A)T - (5.8557 \times 10^{-7} + B)T^2}{0.00398066 - 5.8557 \times 10^{-7} \times T \times 2}$$

T is in the units of $^{\circ}C$ and the constants A and B in equation (1) are calculated using the IPTS68 constants found on the Y2039 RTD probe's calibration report as follows:

$$A = ALPHA \times (1 + DELTA/100)$$

$$B = 10^{-4} \times ALPHA \times DELTA$$

2300A Scanner For Thermocouple and RTD Systems



2300A SCANNER

FEATURES

* Temperature scanner compatible with the 2180A or 2190A Digital Thermometers.
* Scans either RTD or thermocouple inputs.
* 2 cards per mainframe, 10 channels per card for maximum of 20 channels per mainframe.
* Expandable via 2301A to 100 channel system maximum.
* Line or 12V dc operation.

SPECIFICATIONS

OPERATING CHARACTERISTICS

Channel Capacity
20 channels internal; control capability for additional 80 channels in 2301A Extender Chassis. 100 channels system maximum.

Scan Speed
Dependent upon measurement instrument and operator-selected delay time.

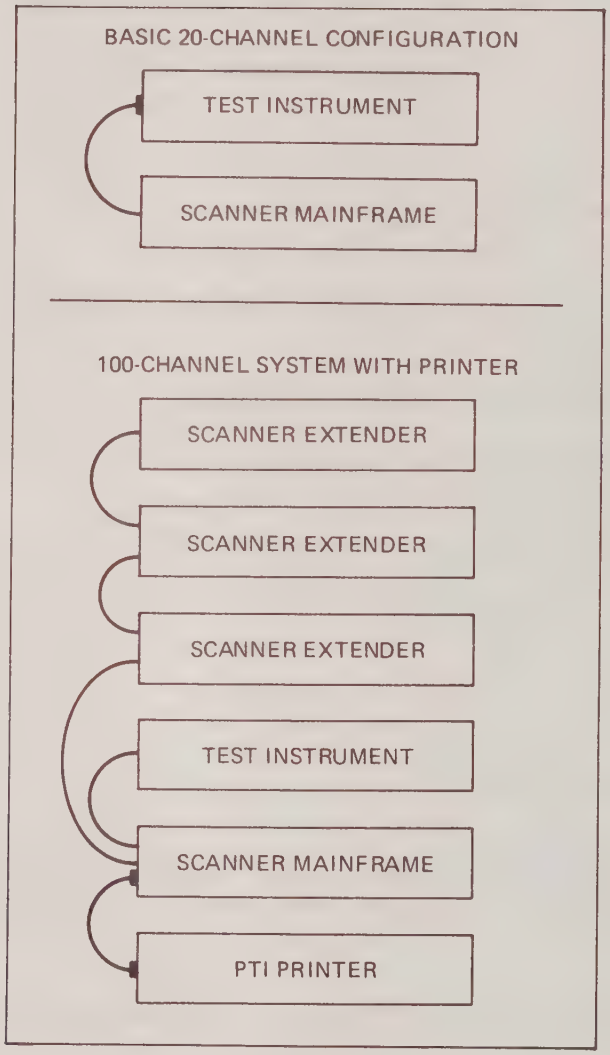
Channel Delay
Operator-selectable: 0 to 9.9 sec.

Scan Modes
Manual or Automatic.

Channel Display
2 Digit LED's

Required Options
One Scanner Card Option and one Interface Option.

Figure 10-1. Typical Scanner System Configurations



CONTROLS, INDICATORS AND CONNECTORS

Refer to Figure 10-2 and Table 10-1 for a description of the 2300A's controls, indicators, and connectors.

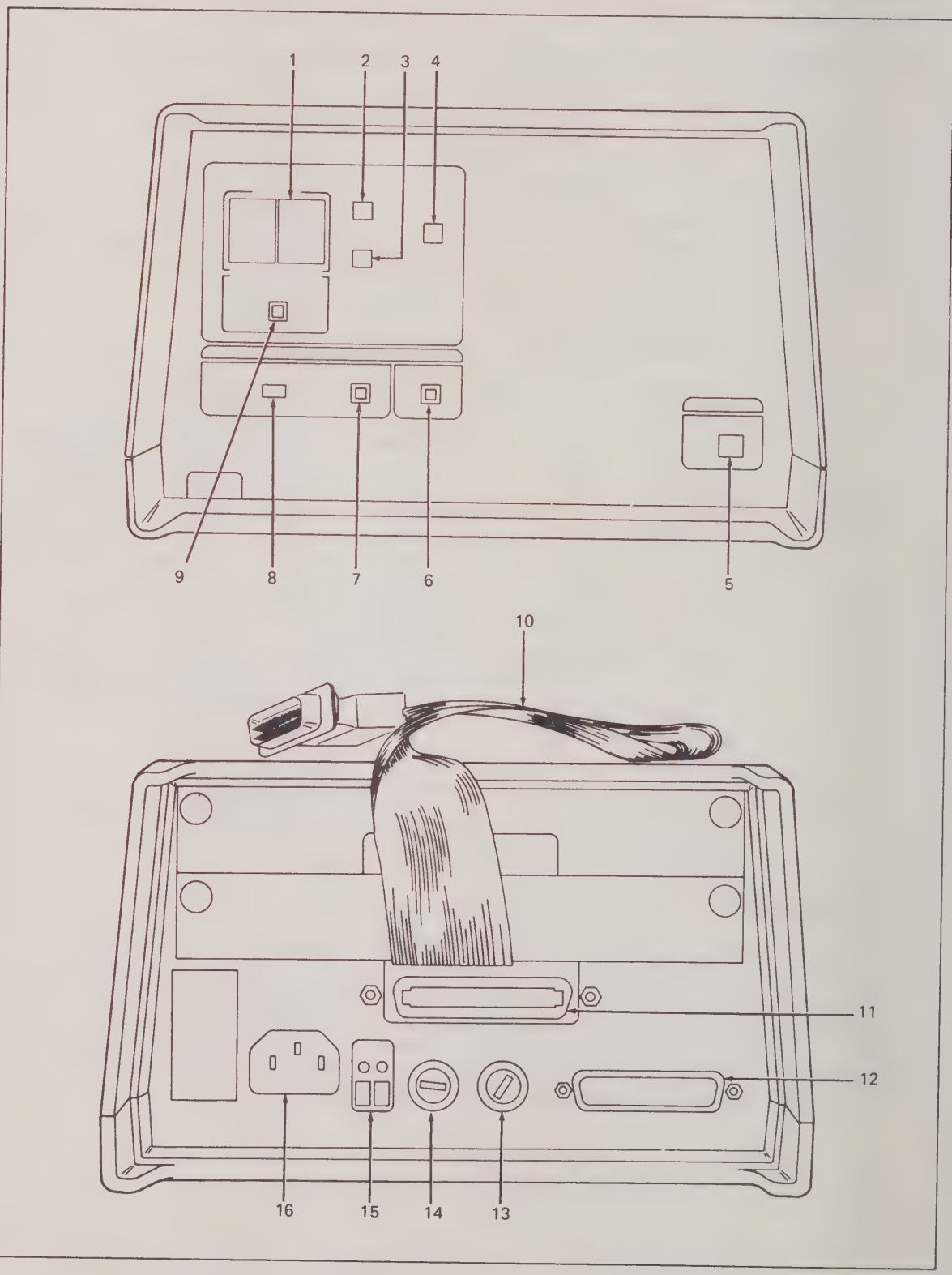
Table 10-1. 2300A Controls, Indicators, and Connectors

REF. NO.	NAME	FUNCTION
1	Channel	Displays channel being scanned or channel delay time.
2	Up	Increment Display.
3	DN	Decrements Display.
4	Skip Select	Programs skip or un-skip of displayed channel.
5	POWER	Switches power to scanner circuitry.
6	MANUAL	Allows manual operator channel scanning and Front Panel programming.
7	AUTO	Selects automatic channel scanning.
8	REMOTE	Light indicates a remote device is controlling the scanner.
9	Channel Delay Select	Channel delay time is displayed when select switch is pressed, if 2300A is in manual mode.
10	Instrument Cable	Cable mounted connection to test instrument.
11	Data I/O Connector	Bidirectional communication connector for printer or system controller.
12	Scanner Extender Connector	Connector for Model 2301A Scanner Extender Chassis.
13	F2	DC Power Fuse
14	F1	AC Power Fuse
15	12V DC	Connector for external dc supply
16	Line Voltage Connector	Line Voltage Input

FUSE REPLACEMENT

The ac line input and external dc input are individually fuse protected. Both fuses are readily accessible from the outside of the rear panel. The ac line input fuse (F1) should be replaced with a 1/8 ampere, slow-blow fuse if the 100 to 130V ac input range is used; the replacement fuse should be 1/16 ampere, slow-blow if the 200 to 260V ac range is used. The external dc input fuse (F2) requires a 3/4 ampere, slow-blow replacement. Ensure that power is OFF and line cord disconnected before replacing fuse.

Figure 10-2. Controls, Indicators, and Connectors



OPERATION

1. The 2300A Scanner mainframe requires one interface and one scanner card in order to operate. The user may choose either a -005 2180A/2190A Interface or a -006 Remote Control Interface. Either a -002 Thermocouple Scanner or a -003 RTD/Ohms Scanner may be used, but not both together in one system. Consult the sections following regarding each of the above options.

2. Configure each option per the instructions given in the manual and/or this guide.

3. The 2300A has two scan modes, AUTO and MANUAL. The AUTO mode automatically cycles through each unskipped channel at the selected delay interval. The MANUAL mode causes the Scanner to continually monitor and display one selected channel.

   A. Select Auto Mode

      1) Before using the Auto mode, the channel delay must be programmed in order to set up the proper scan interval. To do this, press the Channel Delay Select button.

      2) Use the Up/Down keys to increase or decrease the scan interval. The channel delay MUST be greater than or equal to 2.0 seconds.

      3) When the user has chosen the desired channel delay, press the MANUAL button. The display will return to displaying a channel number.

      4) Skip any unconnected channels, if desired. See the instructions on Skip Select.

      5) To begin the Auto-Scan, press the AUTO key.

      6) To stop the Auto-Scan, press the MANUAL key.

   B. Select Manual Mode

      1) The Channel display should be set to the desired channel to monitor.

      2) To do this, press the Up or Dn keys until the Scanner increments or decrements to the proper channel.

      3) The Scanner will now monitor this channel continually.

4. The 2300A allows the user to Skip in the AUTO mode any unused channels, or other channel which the user wishes to ignore. All skipped channels may be unskipped as well.

A. To Skip Channel

1) From the MANUAL mode, press the Up/Dn keys until the desired channel to be skipped is displayed.

2) Press the Skip Select key. The Skip LED will light to indicate that the channel will be skipped in the AUTO mode.

B. To Unskip Channel

1) From the MANUAL mode, press the Up/Dn keys until the desired channel to be unskipped is displayed. Unskipping means that the channel will once again be displayed during an Auto-Scan.

2) Press the Skip Select key. The Skip LED will turn off to indicate that the channel is now unskipped.

5. The 2300A may be remotely programmed and controlled with the -006 Remote Control Interface. If the remote control device places the 2300A into the Remote mode, the 2300A's Remote LED will light. The user will not be able to program the 2300A from the front panel until the remote control device places the 2300A back into the Local mode.

NOTE:

Channel Delay Time
Fluke thermometers require a minimum delay of 2.0 seconds

Use of 2190A with 2300A
The zero on the 2190A must be adjusted. Consult manual for description

A -005 or -006 Option is required in order to function.

2300A SCANNER OPTIONS

2300A-002 T/C Scanner Card
2300A-003 RTD/Ohms Scanner Card
2300A-005 2180A/2190A Interface
2300A-006 Remote Control Interface
2301A Scanner Extender

2300A-002 THERMOCOUPLE SCANNER CARD

FEATURES

* 10 channel, 1uV scanner card
* Accepts inputs from low voltage measurement devices (thermocouples).
* Maximum of 2 cards per scanner mainframe.
* 2 different thermocouple types per card possible.

SPECIFICATIONS

NOTE: Environmental specifications equal those of 2300A

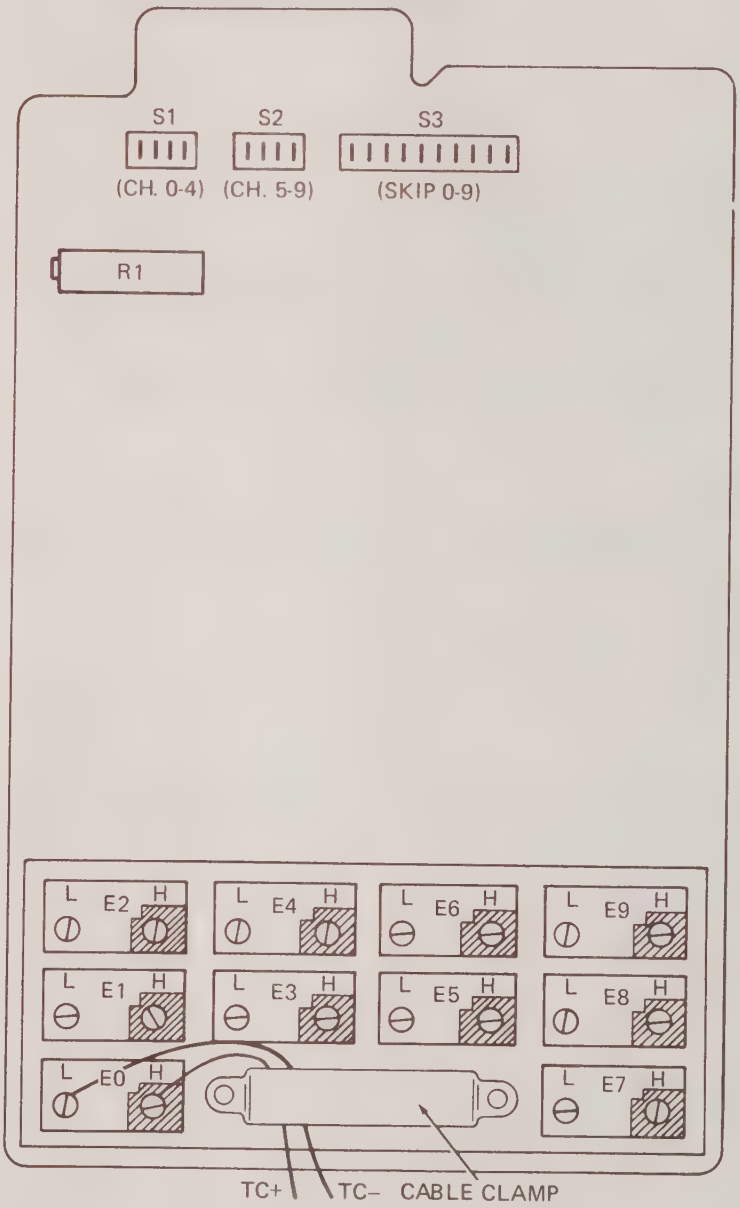
Channel Relays
10 very low Thermal-EMF Relays

Poles/Channel
2

Max Input Voltage
350V dc; 350V ac Peak between any two channels or between any channel and the chassis.

Thermal Offset Error
1uV Maximum.

Figure 11-1. Thermocouple Connections



SWITCHES and ADJUSTMENTS

1. Thermocouple Type Select Switches S1 and S2

   A. Selects the proper linearization for T/C type input
   B. Meaning of code depends on which uP type 2190A is in use
   C. S1 control channels 0-4
   D. S2 controls channels 5-9
   E. S1 and S2 may be set to different T/C types

Table 11-1. Thermocouple Type Select Switch Settings

SELECTION CODE	SWITCH POSITIONS 1	2	3	4	u/C TYPE 1	u/C TYPE 2	u/C TYPE 3
0	OFF	OFF	OFF	OFF	J	J	J DIN
1	ON	OFF	OFF	OFF	K	K	K
2	OFF	ON	OFF	OFF	T	-	T DIN
3	ON	ON	OFF	OFF	-	E	-
4	OFF	OFF	ON	OFF	C	-	B
5	ON	OFF	ON	OFF	-	S	-
6	OFF	ON	ON	OFF	R	R	R
7	ON	ON	ON	OFF	Display Blanked	Display Blanked	Display Blanked

2. Channel Skip Select S3

   A. When set to on, channel will be skipped on initialization
   B. May be "unskipped" from front panel at any time

3. Calibration Potentiometer R1

   A. Used when calibrating 2300A-002
   B. Before performing the Thermocouple Scanner Card calibration procedure, verify accuracy of the required Model 2190A Digital Thermometer by performing the digital thermometer calibration procedure, or the digital thermometer performance test. The following procedure must be used to insure scanner card accuracy after any repair, or each time the thermocouple type is changed:

      1. Connect a thermocouple to input terminal E0 on the Thermocouple Scanner Card.

      2. Install the Thermocouple Scanner Card in a Scanner Mainframe.

3. Connect a 2190A Digital Thermometer to the Scanner Mainframe as described in the 2300A Scanner Mainframe installation instructions.

4. Select the proper switch code for the thermocouple in use.

5. Insert the thermocouple and an accurate (plus or minus .01 degree) mercury thermometer in a lag bath. (See lag bath construction procedure.)

6. Select the proper scanner channel using the 2300A Scanner Mainframe front panel controls.

7. Allow the system to stabilize, then adjust potentiometer R1 on the Thermocouple Scanner Card to obtain a temperature display on the digital thermometer equal to the mercury thermometer indication.

8. Repeat steps 1 through 6 for the remaining scanner channels to verify correct operation.

2300A-003 RTD SCANNER CARD

FEATURES

* 10 channels per card
* 2, 3, or 4 wire measurements
* 2 different RTD types per card possible
* Any of 6 different RTD types available

SPECIFICATIONS

NOTE: Environmental specifications equal those of 2300A.

Channel Relays
10 low thermal EMF Relays

Poles/Channel
3

Max Input Voltage
30V dc; 30V ac

RTD CONNECTIONS

Refer to Figure 11-2 to determine the proper method of connecting RTD's to the input terminals of the 2300A-003. Figure 11-3 shows the location of the various switches and terminal connections.

Figure 11-2. 2, 3, and 4-Wire RTD Connections

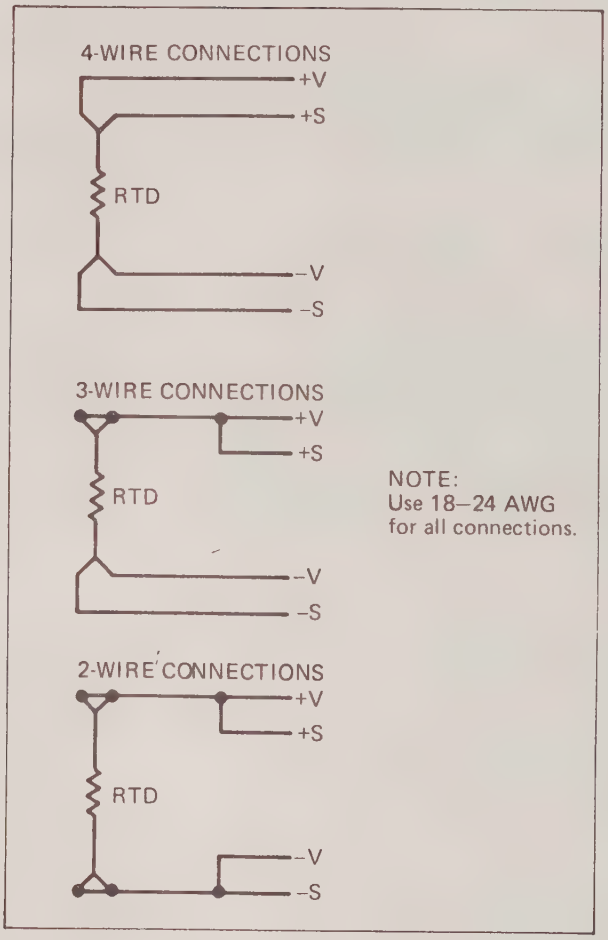
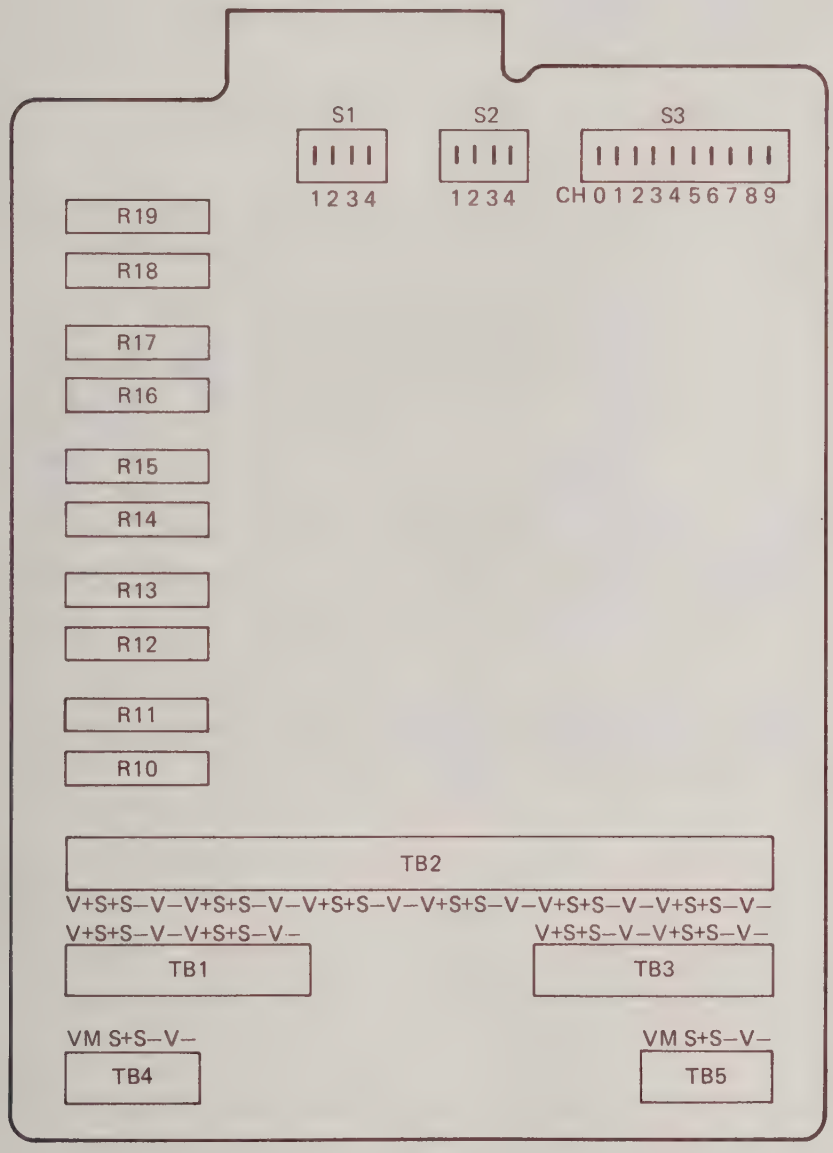


Figure 11-3. Switch and RTD Connection Locations



SWITCHES and ADJUSTMENTS

1. RTD Type Selection Switches S1 and S2

   A. Selects the proper linearization for RTD-type input
   B. S1 controls channels 0-4
   C. S2 controls channels 5-9
   D. S1 and S2 may be set to different RTD types

Table 11-2. RTD Type Selection Codes

SELECTION CODE	RTD TYPE	SWITCH SEGMENT 1	2	3	4
0	385 Pt	OFF	OFF	OFF	OFF
1	390 Pt	ON	OFF	OFF	OFF
2	3916 Pt	OFF	ON	OFF	OFF
3	392 Pt	ON	ON	OFF	OFF
4	100 Ohm Ni	OFF	OFF	ON	OFF
5	10 Ohm Cu	ON	OFF	ON	OFF

2. Skip Enable Switch S3
   A. At power up, those channels corresponding to the switches set to "ON" will be skipped in AutoScan
   B. Channels may be "unskipped" at any time from the front panel

3. Calibration Potentiometers (R10-R19)
   A. Used to individually calibrate each channel of 2300A
   B. Consult manual for calibration procedure

2300A-005 INTERFACE (2180A/2190A)

FEATURES

- Allows scanner to interface to 2180A/2190A and PTI printers, 2020A and 2030A
- RS-232-C output only
- 20 mA TTY current loop output available
- No remote control possible

NOTE: It is possible to upgrade a -005 option to a -006 without purchasing the entire option. Contact your Fluke sales office for part numbers.

SPECIFICATIONS

NOTE: 2300A-005 meets all the environmental specifications of the 2300A.

Interface Capability
Scanner to: 2180A or 2190A Digital Thermometer, and PTI Printer (2020A-001, 2020A-004, 2030A)

Thermometer Output
Optically isolated

Printer Output
PTI standard Bit-parallel, character-serial ASCII. Addresses 1, 6, 7, 8 and 9.

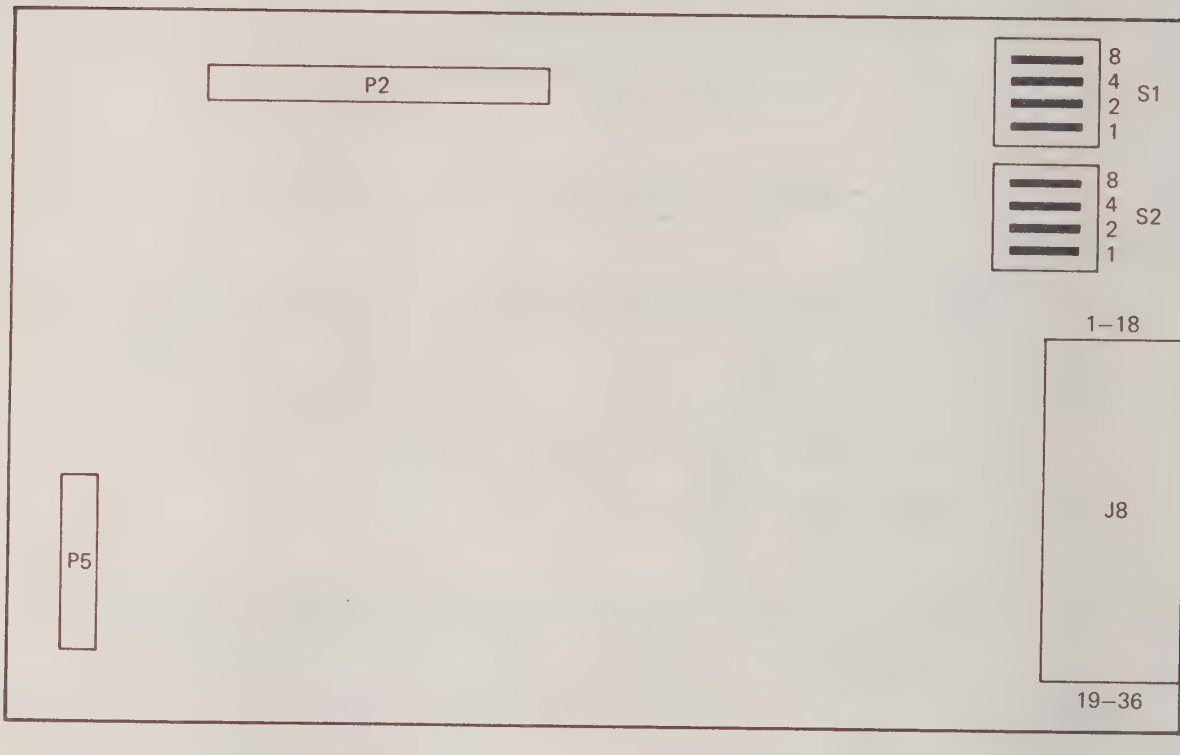
Thermometer Connector
Cable-mounted 25-pin male

Printer Connector
Board-mounted 36-pin female

RS-232-C
Output only: 110, 150, 300, 600, 1200, 4800, 9600 baud.

Current Loop
20 mA, output only

Figure 11-4. 2300A-005 Switch and Connector Locations



SWITCH SETTINGS

1. S1-Baud Rate Select. Set S1 when RS-232-C output only is required.

Table 11-3. RS-232-C Baud Rate Selection

BAUD RATE	SWITCH SEGMENTS			
	1	2	3	4
110	OFF	OFF	OFF	-
150	ON	OFF	OFF	-
300	OFF	ON	OFF	-
600	ON	ON	OFF	-
1200	OFF	OFF	ON	-
2400	ON	OFF	ON	-
4800	OFF	ON	ON	-
9600	ON	ON	ON	-

NOTE: Segment 4 may be in either position.

NOTE: When using the 1120A IEEE-488 Translator with the 2XXXA-522 personality card, set the baud rate to 2400 and follow all details regarding the RS-232-C interface.

2. Address Select: S2

A. The Address Select switch S2 needs to be set when the 2300A Scanner is controlled by a 2020A or 2030A Printer. Since the Printers use the Parallel ASCII/Handshake data format, only address positions 1, 6, 7, 8, 9 are valid addresses. Refer to Table 11-4 for S2 switch settings.

Table 11-4. Printer Addresses, S2

SWITCH S2				ADR. NO.	DATA TYPE/ TRANSFER MODE
4	3	2	1		
OFF	OFF	OFF	OFF	0	
OFF	OFF	OFF	ON	1	Parallel ASCII/Handshake
OFF	OFF	ON	OFF	2	BCD/Clocked
OFF	OFF	ON	ON	3	BCD/Clocked
OFF	ON	OFF	OFF	4	BCD/Clocked
OFF	ON	OFF	ON	5	BCD/Clocked
OFF	ON	ON	OFF	6	Parallel ASCII/Handshake
OFF	ON	ON	ON	7	Parallel ASCII/Handshake
ON	OFF	OFF	OFF	8	Parallel ASCII/Handshake
ON	OFF	OFF	ON	9	Parallel ASCII/Handshake
ON	OFF	ON	OFF	F	None

NOTE: When using the RS-232-C interface, set the address switches to 1, 6, 7, 8, 9.

NOTE: To operate with 2020A or 2030A PTI Printer, select addresses 1, 6, 7, 8, 9.

RS-232-C OPERATION

A. With the -005 Interface option, RS-232-C operation is limited to output only. If it is desired to output data to an RS-232-C standard printer or computer, it will be necessary to either hard wire from a standard RS-232-C connector to the PTI connector located on the rear of the Scanner, or purchase the Y2026B RS-232-C adapter.

B. The RS-232-C data format is a 19 character ASCII string. Table 11-5 describes the string format for 3 operating conditions: 1) Normal output, 2) Open thermocouple detect, and 3) Overrange detect.

C. The RS-232-C output is not available when the 2300A is powered from a 12V dc source.

Table 11-5. Measurement Data Output Format for RS-232-C and Current Loop Ports

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
NORMAL OUTPUT																		
CH	CH	SP	SP	SP	±	D	D	D	D/.	D/.	D	SP	SP	SP	F/C	SP	CR	LF
OPEN THERMOCOUPLE OUTPUT																		
CH	CH	SP	SP	SP	±	D	D	D	D/.	D/.	?	SP	SP	F/C	0	T	CR	LF
OVERRANGE OUTPUT																		
CH	CH	SP	SP	SP	+	D	D	D	D/.	D/.	D	SP	SP	F/C	0	R	CR	LF

NOTE: If the Limits option in the thermometer is installed (option 21X0A-006) and is indicating a limit condition, character slot 4 will be an exclamation point (!) for any of the three above modes.

SYMBOL	DESCRIPTION
CH	Channel Identification numbers (00 thru 99)
SP	Space
!	Thermometer limits Option Setpoint exceeded symbol
±	Plus or minus symbol
D	Temperature data values (0 thru 9)
.	Floating decimal point, will be character slots 11 or 12 when used with 2180A Thermometer, decimal point will be in character slot 12 with 2190A Thermometer respectively.
F/C	Fahrenheit or Celsius
CR	Carriage Return
LF	Line Feed
?	Question mark
OT	Open Thermocouple (Character slots 16 and 17)
OR	Over Range (Character slots 16 and 17)

Table 11-6. RS-232-C Interface Signals For The -005 Interface Option

CONNECTOR J8 PIN	NAME	DIRECTION	OPERATION
30	Transmitted Data	Out	Data sent from the Scanner to an external device.
28	Scanner Busy	Out	The Scanner sets Scanner Busy low when it is unable to receive.
34	Signal Common	---	---
32	Clear to Send	In	If an external device pulls CTS low, the 2300A stops communicating. Leaving CTS open or pulling it up allows the 2300A to resume communications.
27	Received Line Signal	In	If an external device pulls RLS low, the 2300A stops communicating. Leaving RLS open or pulling it up allows the 2300A to resume communciations.
31	Request to Send	Out	The 2300A always pulls RTS up to +12V
29	Data Terminal	Out	The 2300A always pulls RTS up to +12V
35	TTY Current Loop (+)		The 2300A supplies 20 milliamp current loop levels. No remote programming via current loop is possible (RS-232-C current loop output only).
36	TTY Current Loop (-)		

2300A-006 REMOTE CONTROL INTERFACE

FEATURES

* Can be used with either 2180A or 2190A, 2300A-002 or -003 T/C or RTD scanner cards, and with 2020A or 2030A Printer
* Bi-directional RS-232-C
* 20 mA TTY current loop, output only

SPECIFICATIONS

The 2300A-006 meets all of the environmental specifications of the 2300A mainframe.

Interface Compatability
2300A to: 2180A, 2190A, 2020A-001, 2020A-004, 2030A, Y2026B, and RS-232-C devices.

Thermometer Output
Optically Isolated

Printer Output
PTI standard bit-parallel, character-serial ASCII, (addresses 1, 6, 7, 8, and 9 are valid)

Thermometer Connector
Cable-mounted, 25-pin male

Printer/RS-232-C Connector
Board-mounted, 36-pin female

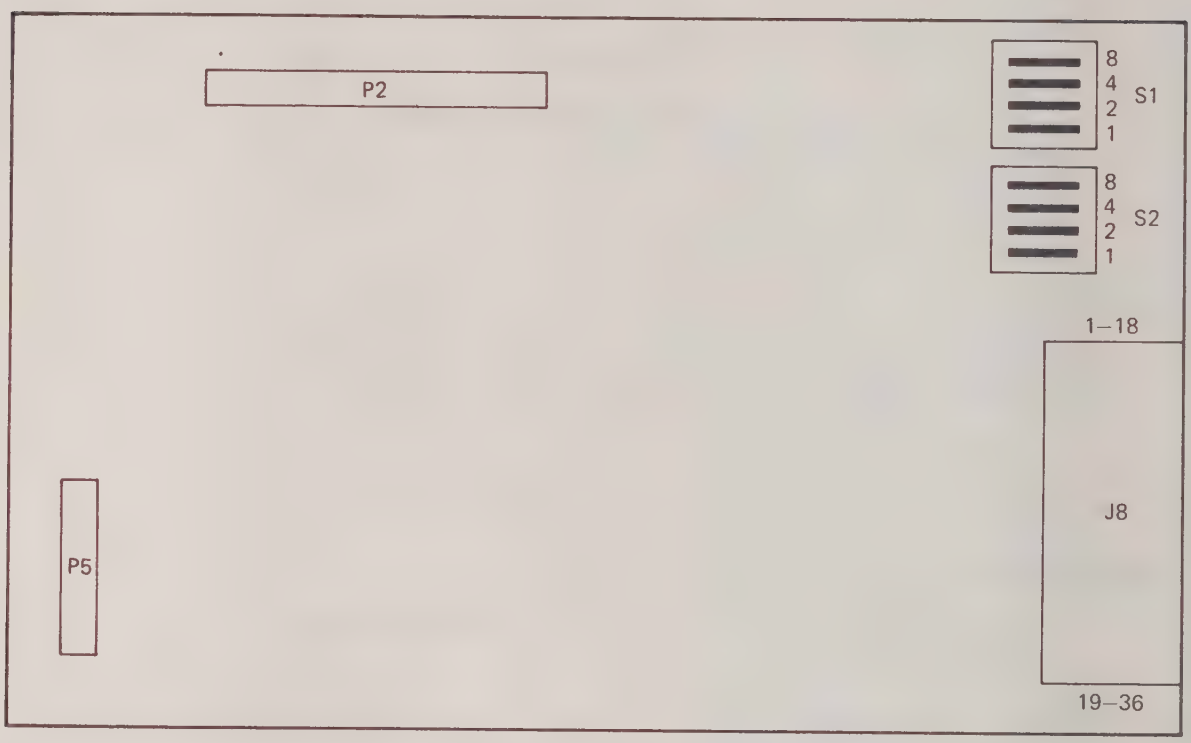
RS-232-C Baud Rates
Switch selectable: 110, 150, 300, 600, 1200, 2400, 4800, and 9600

RS-232-C I/O
Bi-directional: Remote control and data monitoring

Current Loop
20 mA, output only

Remote Commands
All 2300A front panel selectable functions

Figure 11-5. 2300A-006 Switch and Connector Location



SWITCH SETTINGS

1. Baud Rate Select: S1 needs to be set when bidirectional RS-232-C operation is required.

Table 11-7. RS-232-C Baud Rate Selection

BAUD RATE	S1 SWITCH SEGMENTS			
	1	2	3	4
110	OFF	OFF	OFF	-
150	ON	OFF	OFF	-
300	OFF	ON	OFF	-
600	ON	ON	OFF	-
1200	OFF	OFF	ON	-
2400	ON	OFF	ON	-
4800	OFF	ON	ON	-
9600	ON	ON	ON	-

NOTE: Segment 8 may be in either position:
ON = ECHO: OFF = NO ECHO

A. The 2300A can operate in echo or non-echo mode. In echo mode (segment 4 of the interface assembly switch S1 is ON), the 2300A echos to the controlling device each character it receives. When the controller send an escape code, the 2300A echos an escape and a carriage return/line feed. Additionally, when the controller sends a carriage return, the 2300A echos carriage return and line feed. In non-echo mode (segment 4 of S1 is OFF) there is no echo.

B. When using the 2XXXA-522 Personality Card and the 1120A IEEE-488 Translator, set the baud rate to 2400 and follow all details regarding the RS-232-C interface.

2. Address Select: S2

A. S2 is used to determine the Printer address to which the Scanner will respond. This is the PTI address and needs to be set when the 2300A is being used with a PTI Printer, like the 2020A or the 2030A. Only addresses 1, 6, 7, 8, or 9 are valid.

B. A Model 2020A printer using the parallel ASCII printer interface (printer Option -001) requires printer address number one to be set through switch S2. The parallel ASCII interface can send only printer address number one. If a 2020A Printer is connected using the PTI printer interface (printer option -004), or if a Model 2030A Printer is in use, then addresses 1, 6,7, 8, and 9 are valid for use on the Remote Control Interface in the 2300A Scanner Mainframe.

Table 11-8. Printer Addresses

SWITCH S2				ADR. NO.	DATA TYPE/ TRANSFER MODE
4	3	2	1		
OFF	OFF	OFF	OFF	0	
OFF	OFF	OFF	ON	1	Parallel ASCII/Handshake
OFF	OFF	ON	OFF	2	BCD/Clocked
OFF	OFF	ON	ON	3	BCD/Clocked
OFF	ON	OFF	OFF	4	BCD/Clocked
OFF	ON	OFF	ON	5	BCD/Clocked
OFF	ON	ON	OFF	6	Parallel ASCII/Handshake
OFF	ON	ON	ON	7	Parallel ASCII/Handshake
ON	OFF	OFF	OFF	8	Parallel ASCII/Handshake
ON	OFF	OFF	ON	9	Parallel ASCII/Handshake
ON	OFF	ON	OFF	F	None

NOTE: Only those addresses which transfer ASCII data in a handshake mode are valid for Option -005 and -006.

C. When using the RS-232-C interface, set the address switches to address 1, 6, 7, 8, or 9.

OPERATION WITH REMOTE CONTROL DEVICE

A. For communication with an RS-232-C device, a Y2026B RS-232-C cable adapter is required. Alternatively, the user may hard wire from the 36 pin PTI connector to his own RS-232-C cable with a standard 25 pin connector.

B. A Model 2020A Printer with interface Option -001 is the recommended printer for use with a remote control device connected to the interface. A Model 2020A with interface Option -004 or a 2030A printer may be used, but, since both the printer and the RS-232-C data set supply some scanner control, a control conflict may develop that would hangup the system. Any printer should be used only in Continuous Print mode if a controlling device is in use. If no controller is in use, any PTI printer (2020A-001, 2020A-004, or 2030A) may be used in any print mode.

C. In order for the 2300A to communicate properly with the controlling device at computer speeds, its "Scanner Busy" signal line must be connected to the controller's signal line which is designed to prevent the controller from sending data (such as Clear-to-Send or Data-Set-Ready). This prevents the controller from sending commands faster than the 2300A can accept them.

D. Reading rate is determined by both the programmed channel delay and the selected baud rate.

E. A list of remote commands which the 2300A recognizes can be found in Table 11-9.

Table 11-9. Remote Control Commands

COMMAND	DESCRIPTION
R	Places Scanner in Remote Mode
L	Places Scanner in Local Mode
D nn or D n.n	Sets Channel Delay = n.n Seconds
S nn	Sets Skip on Channel nn
S nn-mm	Sets Skip on Channels nn-mm
U nn	Clears Skip on Channel nn-mm
M nn	Monitor Channel nn
A	Automatic Scan
A nn-mm	Automatic Scan Channels nn-mm
X	Single Scan
X nn-mm	Single Scan Channels nn-mm
RP	Print Scan Mode on Controller
MP	Print Current Channel on Controller
AP	Print first and last channel number on Controller
XP	Print first and last channel number on Controller
DP	Print Channel Delay time on Controller
ESC (hex 1B)	Shift from Command Mode to Monitor Mode and from Monitor Mode to Command Mode

A. All of the commands listed in Table 11-9 must be sent followed with a CR LF, with the exception of the ESC command.

B. Up to 15 characters may be sent in a command string, but the Scanner will ignore all commands except the one just prior to the CR LF. This is to permit a user to correct his/her typing errors without having to hit the RETURN key and receive an error message.

C. Remote Control Modes

1. DATA: This mode outputs data continuously at the programmed scan interval and baud rate.

2. COMMAND: In this mode, the 2300A accepts commands sent to it from the remote control device,

3. Shifting from one mode to the other is accomplished by sending the ESC command (without the CR LF). In effect, the ESC toggles the 2300A from the DATA mode to the COMMAND mode, and vice versa.

D. Error Messages

The following are possible error messages which the 2300A will send when programmed remotely.

1. TYPE R FIRST: This message tells the user that the 2300A is in the local mode and will not accept remote commands. The user must first type the command 'R,' and then resend the desired command. Some commands, which do not affect the Scanner operation, are allowed in the local mode. These include RP, MP, AP, XP, etc.

2. SYNTAX ERROR: This message tells the user that the 2300A was unable to understand the command sent to it. Usually the error is in typing, or in using a command letter which is not valid.

3. nn NOT THERE: If the user attempts to monitor or scan a channel which is not physically in the system, then the 2300A will send the nn NOT THERE error message.

E. Command Responses

1. Table 11-10 shows the 2300A's response format to each of the commands possible.

2. The ESC command will have two responses, depending on which mode the 2300A is found.

   a. If the 2300A is in the DATA mode, then sending the ESC command will toggle it into the COMMAND mode. At that point, the 2300A will send the string '? CR LF.' The 2300A will send no further output after this initial string, and will simply sit there awaiting a command input.

   b. If the 2300A is in the COMMAND mode, then sending the ESC command will toggle it into the DATA mode. At that point, the 2300A will begin outputting data at the programmed scan interval and baud rate.

3. BASIC Controllers, such as the Fluke 1720A use the 'CHR$(27);' command to send the ESC character without the CR and LF.

4. The '? CR LF' character string may be preceded by the 19 measurement data characters previously generated by the thermometer before the ESC command was received.

5. The Scanner will continue to finish making an answer on the channel to which it is selected before it will respond to a new command.

6. It is recommended that after sending the ESC command to place the 2300A into the COMMAND mode, a reading should be taken until a '? CR LF' string is found.

7. The ESC command, when received by the 2300A-006, does not stop the thermometer from scanning, only from printing it.

8. Each command response is delayed by up to 300 msec for the thermometer to complete its measurement it is working on, plus the delay time that is programmed. The programmed delay time should be at least 2.0 seconds when the Scanner is to be used with the 2180A or 2190A thermometer in order to achieve the rated accuracy.

9. It is suggested that after each command is sent, the user take a reading from the 2300A in order to drain the output buffer of the Scanner.

10. An easy way to look for the '? CR LF' response in a BASIC program is to set your string variable equal to a question mark (STRING = ?).

Table 11-10. Command Response Output Format For RS-232-C Port

INPUT COMMAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Escape	?	CR	LF											
R,L,D,S,U,M,A, X	SP	CR	LF											
RP (Auto Mode)	A	U	T	O	SP	M	O	D	E	CR	LF			
RP (Manual Mode)	M	A	N	U	A	L	SP	M	O	D	E	CR	LF	
MP	C	H	A	N	N	E	L	SP	M	O	D	E	CR	LF
AP or XP	S	C	A	N	SP	n	n	-	m	m	CR	LF		
DP	D	E	L	A	Y	SP	=	SP	n	'	n	CR	LF	

RS-232-C OPERATION

The RS-232-C data format is a 19 character ASCII string. Table 11-11 describes the string format for 3 operating conditions: 1) Normal output, 2) Open thermocouple detect, and 3) Overrange detect.

Table 11-11. Measurement Data Output Format For RS-232-C and Current Loop Ports

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
NORMAL OUTPUT																		
CH	CH	SP	SP	SP	±	D	D	D	D/.	D/.	D	SP	SP	SP	F/C	SP	CR	LF
OPEN THERMOCOUPLE OUTPUT																		
CH	CH	SP	SP	SP	±	D	D	D	D/.	D/.	?	SP	SP	F/C	O	T	CR	LF
OVERRANGE OUTPUT																		
CH	CH	SP	SP	SP	+	D	D	D	D/.	D/.	D	SP	SP	F/C	O	R	CR	LF

NOTE: If the Limits option in the thermometer is installed (option 21X0A-006) and is indicating a limit condition, character slot 4 will be an exclamation point (!) for any of the three above modes.

SYMBOL	DESCRIPTION
CH	Channel Identification numbers (00 thru 99)
SP	Space
!	Thermometer limits Option Setpoint exceeded symbol
±	Plus or minus symbol
D	Temperature data values (0 thru 9)
.	Floating decimal point, will be character slots 11 or 12 when used with 2180A Thermometer, decimal point will be in character slot 12 with 2190A Thermometer respectively.
F/C	Fahrenheit or Celsius
CR	Carriage Return
LF	Line Feed
?	Question mark
OT	Open Thermocouple (Character slots 16 and 17)
OR	Over Range (Character slots 16 and 17)

NOTE: The RS-232-C Interface is NOT active when the 2300A is powered from the 12V dc rear panel inputs.

Table 11-12. RS-232-C Interface Signals

PIN	NAME	DIRECTION	OPERATION
30	Transmitted Data	Out	Data sent from the Scanner to an external device.
26	Received Data	In	Data sent from an external device to the Scanner (-006 Option only).
28	Scanner Busy	Out	The Scanner sets Scanner Busy low when it is unable to receive.
34	Signal Common	---	---
32	Clear to Send	In	If an external device pulls CTS low, the 2300A stops communicating. Leaving CTS open or pulling it up allows the 2300A to resume communications.
27	Received Line Signal	In	If an external device pulls RLS low, the 2300A stops communicating. Leaving RLS open or pulling it up allows the 2300A to resume communciations.
31	Request to Send	Out	The 2300A always pulls RTS up to +12V
29	Data Terminal	Out	The 2300A always pulls RTS up to +12V
35	TTY Current Loop (+)		The 2300A supplies 20 milliamp current loop levels. No remote programming via current loop is possible (RS-232-C current loop output only).
36	TTY Current Loop (-)		

2300A REMOTE CONTROL PROGRAMMING HINTS

IEEE-488 PROGRAMMING

When used with a Fluke 1120A IEEE-488 Translator and 2XXXA-522 RS-232 personality Card, a 2300A can be programmed via an IEEE-488 controller. The following is a suggested procedure for remotely controlling the 2300A, as well as background information on the scanner.

The scanner has two modes: DATA and COMMAND. On power-up, the 2300A is always in the DATA mode. In this mode, the 2300A is outputting data to the controller, but will not accept any commands unless toggled into the COMMAND mode. This toggling is accomplished by sending the 2300A an ESC (ASCII decimal 27). To switch from the COMMAND mode to the DATA mode, simply send another ESC. (Note:

sending ESC with CR LF will generate a syntax error message.)

Once in the COMMAND mode, the 2300A will respond with a '?' to indicate that it is ready to accept commands. No further communication will be forthcoming until a command is given.

The first command to be given (aside from toggling back to the DATA mode without having sent a command) MUST be 'R' to place the 2300A into remote. All commands should be followed with a CR (carriage return). Sending any command besides 'R' will result in the error message 'TYPE R FIRST.' If the 2300A accepts this command, the remote LED on its front panel will light up and the scanner will send SP CR LF to indicate that it has accepted this command and is awaiting another command.

The 2300A will send this SP CR LF sequence each time a command is accepted. If the user is remotely programming the scanner via the IEEE-488 GPIB, he/she must read from the 2300A in order to clear the bus and allow the 2300A to accept further commands.

Although the 2300A will indicate that it has accepted a command, certain commands will not be executed until the scanner is returned to the DATA mode.

Since the 2300A sends a confirmation that a command has been accepted, it is not possible to send multiple commands. If the user sends more than one command, followed by a CR, the scanner will attempt to carry out the command immediately preceding the CR. This means that any incorrect commands or typing errors do not need to be erased: just continue on the same line and type the correct command, followed by a CR.

Before remotely controlling the scanner, the user must know if the unit is in the DATA or COMMAND modes. This may be difficult to ascertain for many reasons, and in most remote control applications it is impossible to guarantee in which mode the unit will be encountered. Therefore, the following procedure is recommended when the 2300A is to be used under computer control.

1. Immediately send the 2300A an ESC.

2. Take a reading from the 2300A.

3. If the reading is a '?' then proceed to send the 2300A commands. (Step 6)

4. If the reading is a piece of data, then repeat steps 2 and 3 until either a question mark is received or three readings have been taken, whichever occurs first.

5. If 3 readings have been taken and they are all data, then send the 2300A an ESC.

6. Proceed to command the 2300A.

Let's examine the process. When first beginning to control the 2300A, the user does not know which mode the unit is in. Consider the following 2 cases.

a) The unit is originally in the DATA mode. After step 1 above, the unit will be toggled into the COMMAND mode by the ESC. At step 2, a reading will be taken. If the 2300A's buffer was empty as the ESC was sent, then the first reading will produce a '?' to indicate that the 2300A is now in the command mode. If, however, a piece of data were in the buffer at the time the ESC was sent, then the 2300A would first send that piece of data. Therefore, a second reading would need to be taken. At this point the '?' would be in the buffer in response to the ESC, and the 2300A would be ready to respond to commands. If the user is programming via the IEEE-488 GPIB, then the buffer in the 1120A could delay reception of the reading even further. That is why it is recommended that at least 3 readings be taken before deciding that the unit is in the DATA mode. Upon receipt of the '?' prompt, however, do not attempt to ask for further readings, as you will get nothing (with IEEE-488, a bus timeout error will occur).

Now let's consider the second case.

b) The unit is originally in the COMMAND mode.

After the ESC in step 1 is sent, the 2300A is placed into the DATA mode. A reading will be taken. As it will not be '?' the user will again ask for a reading. This will be repeated for a total of 3 times. Since all the readings were data, the 2300A is in the DATA mode. Step 5 sends the ESC which will toggle the unit back into the COMMAND mode, where the 2300A can be commanded.

2301A SCANNER EXTENDER

FEATURES

* For use with 2300A Scanner mainframe
* 30 channels per extender
* 3 scanner extenders required for maximum 100 channel system

SPECIFICATIONS

Operating Characteristics

Channel Capacity
30 Channels: 3 scanner option PCB's, 10 channels/PCB.

Scan Speed
Established though 2300A Scanner Mainframe

Channel Delay
Established through 2300A Scanner Mainframe

Scan Modes
Established through 2300A Scanner Mainframe

Displays
Uses 2300A Scanner Mainframe Displays

Required Options
Minimum of one scanner card option. (3 scanner cards maximum.)

Figure 11-6. Scanner Extender Features

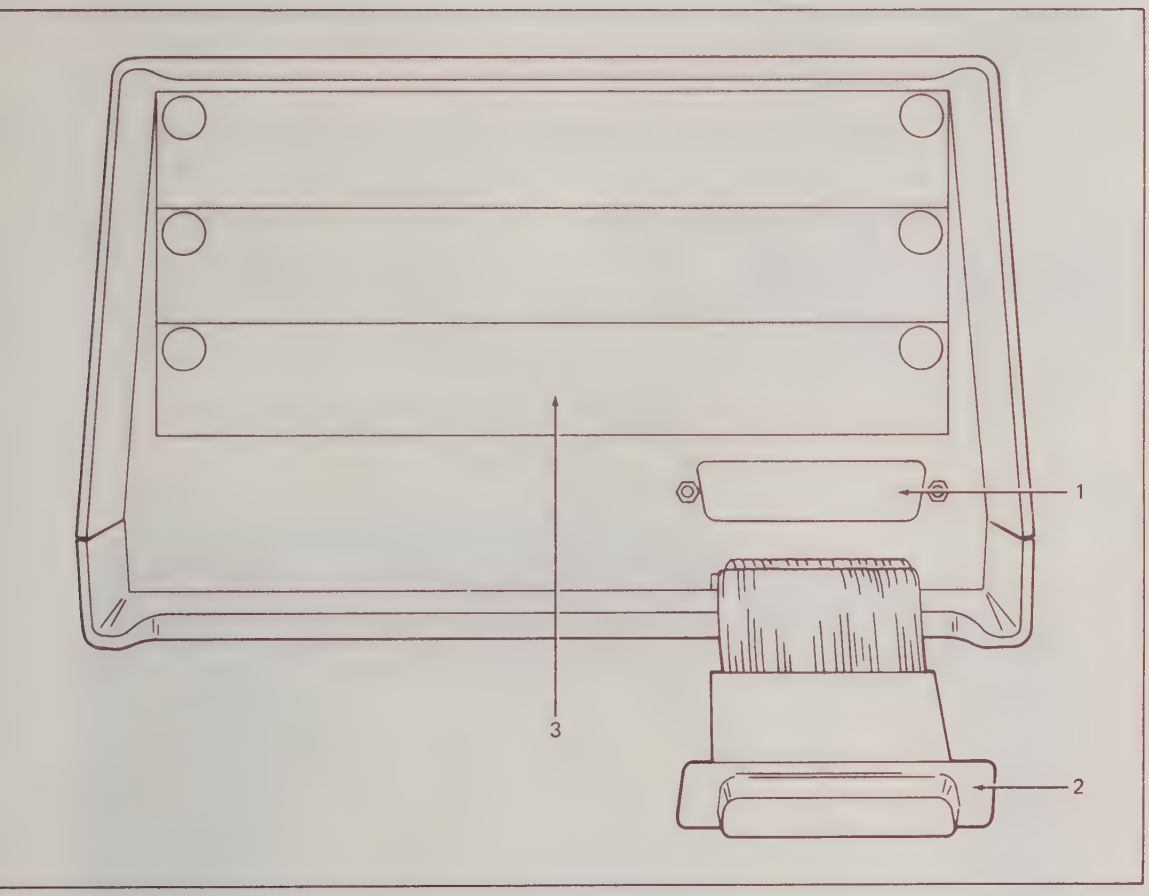
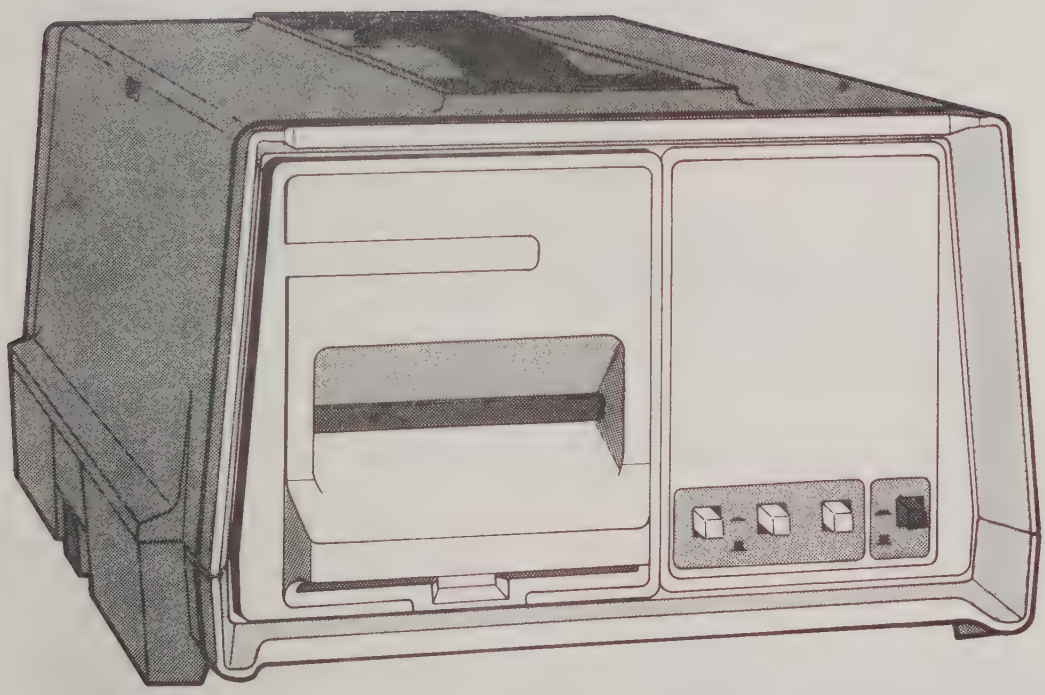


Table 11-13. 2301A Extender Features

REF NO.	FEATURE	PURPOSE
1	Scanner Extender Connector	Provides for daisy-chain connection of an additional extender.
2	Scanner Extender Cable	Provides connection to either another extender or a 2300A Scanner Mainframe.
3	Scanner Option Card Blank Cover	Cover option installation slot.

2020A Printer



2020A PRINTER

The model 2020A Printer is a 20 character thermal line printer designed specifically as a recording peripheral device for use with digital measurement instruments.

FEATURES

- 64 character ASCII set plus special codes for <micro>, <ohm>, f, m, n, p, s, z.
- Plot mode operation
- 5 optional interface PCB's
  --Parallel ASCII
  --RS-232-C
  --IEEE-488
  --Parallel BCD
  --PTI (unique Fluke format)
- Interval print option from 10 sec. to 8 hours
- Remote print command accessed via relay at back of unit
- Either 115V ac input power or 12V dc input power for portable operation.

ACCESSORIES

Four accessories are available for use with the model 2020A Printer:

- Y7203 cable (2 feet)
- Y7204 cable (5 feet)
- Y2028 BCD to ASCII interface
- Y2034 Interconnect accessory

Both cable assemblies are direct pin to pin cables for use with the 2020A Printer operating with either the parallel ASCII interface option (-001) or the PTI interface option (-004). Both cables have a 36 pin amp "Champ" male and female connector. The Y7203 is 2 feet long and the Y7204 is 5 feet long.

OPTIONS	DESCRIPTION
*2020A-001	Input Interface - Parallel ASCII
*2020A-002	Input Interface - RS-232-C
*2020A-003	Input Interface - IEEE-488
*2020A-004	Input Interface - PTI
*2020A-005	Input Interface - Parallel BCD
2020A-006	Interval Timer Option

ACCESSORY	DESCRIPTION
Y2028	BCD to PTI Converter (use with Options -001 and -004)
Y2034	Interconnect Box - 5 input connectors, 1 output connector to printer (use with -004)
Y7203	Interconnect Cable - 2 feet, 36 pin
Y7204	Interconnect Cable - 5 feet, 35 pin

*NOTE: The 2020A must be configured with one of the marked options.

GENERAL INFORMATION

PRINTHEAD TEST	Prints all slash marks (/) if PAPER ADVANCE is pushed within one second of POWER ON.
REMOTE PRINT	Remote contact closure initiates print cycle.
PLOT MODE	With options -001 and -003 only.
TYPE	Thermal
CHARACTER	5 X 7 Dot Matrix
PRINT RATE	3 Lines per second
NUMBER OF COLUMNS	20
LINE SPACING	Approximately 2.5 lines per cm (6 lines per inch)
PAPER	Thermal Sensitive, 2.5 inch X 240 foot roll, (3M Type 162)

CONTROLS, INDICATORS & CONNECTORS

See Figure 12-1 and Table 12-1 for a description of the 2020A controls, indicators, and connectors.

Figure 12-1. Controls, Indicators, and Connectors

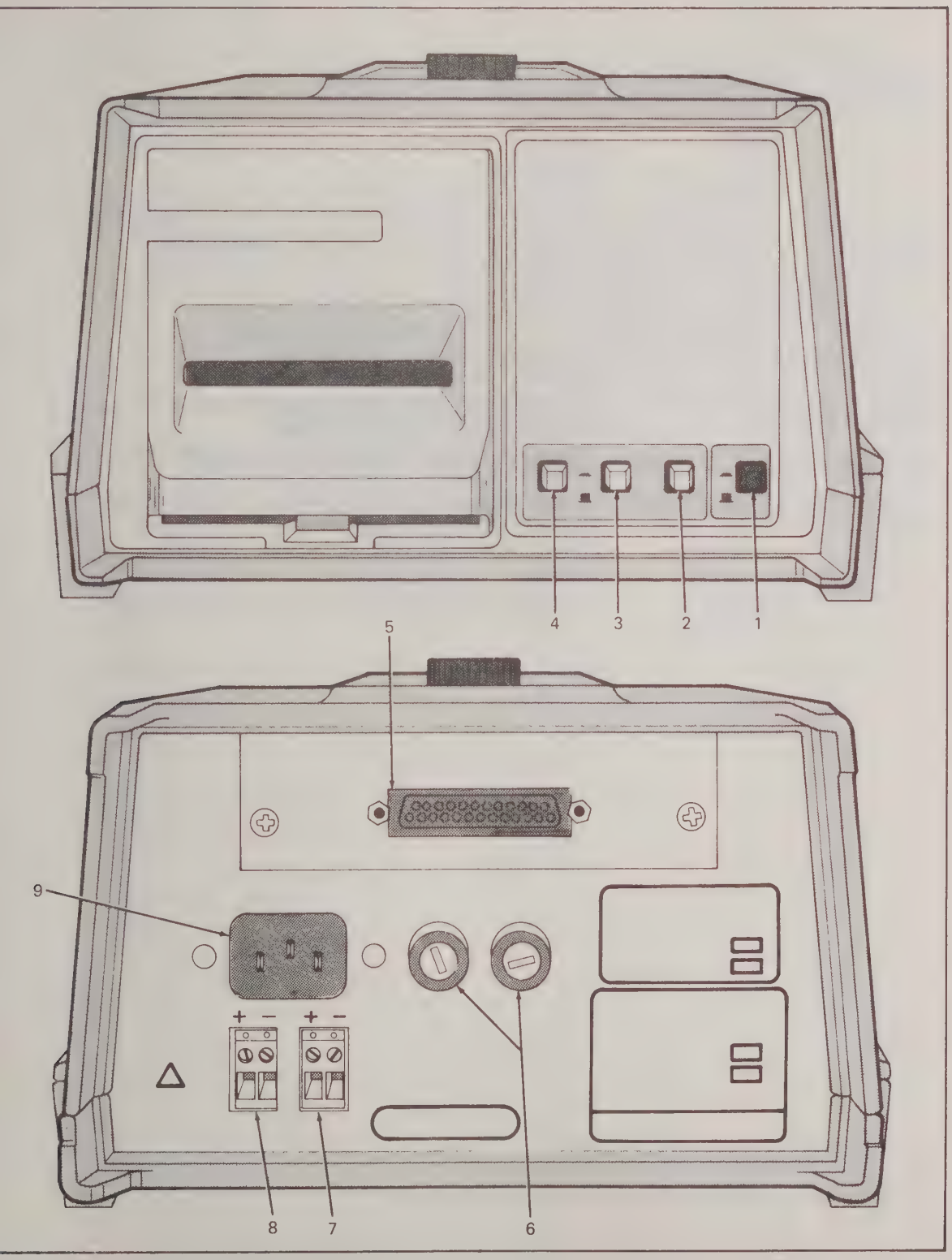


Table 12-1. Controls, Indicators, and Connectors

REF	CONTROL NAME	CONTROL FUNCTION
1	POWER	Applies power to, or removes power from instrument
2	PAPER ADV	Advances printer paper
3	CONT. PRINT	Initiates Continuous printing of input data
4	SINGLE PRINT	Initiates Single Print of input data
REF	**CONNECTOR NAME**	**CONNECTOR FUNCTION**
5	Data Connector	Connections for data transfer between input test instrument and printer
6	Fuses	Fuses for input line power (F1) and 12V dc input voltage (F2)
7	Print Command	Input terminals for a remote single print switch
8	DC Input Connector	Input terminals for external dc power source
9	AC Line Connector	Power cord connection for ac line voltage

2020A PRINTER OPTIONS

2020A-001 Parallel ASCII Interface
2020A-002 RS-232-C Interface
2020A-003 IEEE-488 Interface
2020A-004 Fluke PTI Interface
2020A-005 Parallel BCD Interface
2020A-006 Interval Timer

2020A OPTIONS

The following sections describe the options for the 2020A Printer. One of the options, -001, -002, -003, -004, or -005 must be ordered with every 2020A ordered. These are the interface boards, and only 1 interface option may be installed in the 2020A at any one time. The -006 option, Interval Timer, may be installed in addition to any one of the interface options.

All 5 interface options operate in the print mode. Only options -001 (parallel ASCII) and -003 (IEEE-488) operate in the plot mode. For more information on how to use the plot mode, see the section following the 2020A options entitled PRINTING AND PLOTTING WITH THE 2020A UNIVERSAL PRINTER.

2020A-001 - PARALLEL ASCII INTERFACE

FEATURES

* Provides buffering between the data bus and the 2020A microcomputer
* Input data in ASCII format with 7 data bits
* Plot mode possible. See the section regarding 2020A plot mode programming at the end of the 2020A options section.

SPECIFICATIONS

Input Connector	Qty. 1; 36-pin Amp
Data Inputs	7 lines; Parallel ASCII
Address	4 lines; input instrument must be set to Address 1
Handshake Signals	Address Valid ($\overline{\text{ADRVL}}$), Data Valid ($\overline{\text{DATVL}}$), Data Acknowledge ($\overline{\text{DTACK}}$)
Logic Sense	
Address & Data	Positive-true ($\geq$3.5V)
Handshake	Negative-true ($\leq$1.5V)
Plug Compatible	2180A and 2190A
Character Set	All 64 Upper Case ASCII plus special characters. See Table 13-1.
Buffer Storage	None

Table 13-1. Special Characters

ASCII CODE		PRINTER CHARACTER
DECIMAL	HEX	
10	0A	(Line feed) Terminate input string
12	0C	Space one line (form feed)
16	10	Initiate plot mode
254	FE	Advance paper one dot location
255	FF	Exit plot mode
100	64	Degree symbol (^{o})
102	66	Lower case f
107	6B	Lower case k
109	6D	Lower case m
110	6E	Lower case n
112	70	Lower case p
114	72	Ohms symbol
115	73	Lower case s
117	75	Micro Symbol
177	7A	Lower case z

NOTE: For further information regarding using the plot mode, see the section at the back of the 2020A options for 2020A plot mode hints.

Table 13-2. Option 2020A-001 - Input Connector Pin Usage

Input Connector Pin Assignments

PIN NO.	MNEMONIC	DESCRIPTION
1	$\overline{\text{ADRVL}}$	Address Valid
2	$\overline{\text{DATVL}}$	Date Valid
3	A0	Instrument Address, LSB
4	A1	Instrument Address, 2SB
5	A2	Instrument Address, 3SB
6	A3	Instrument Address, MSB
7	$\overline{\text{DTACK}}$	Data Acknowledge
8	$\overline{\text{SCNIP}}$	Scan In Progress
9	D0	LSB
10	D1	2SB
11	D2	3SB
12	D3	4SB
		Input Data Lines
13	D4	5SB
14	D5	6SB
15	D6	7SB
16	D7	MSB
17	GND	Common Return
18	+5	Supplied by printer
19-36	---	Not used by printer

2020A-002 - RS-232-C INTERFACE

FEATURES

* The RS-232-C Interface accepts bit serial ASCII format information.
* It contains a 32 word buffer.
* An active clear to send (CTS) signal is provided to prevent buffer overflow.
* The baud rate is internally switch selectable.
* The interface is field or factory installable
* All input data and voltage levels conform to EIA standard RS-232-C.
* Electrical connection is through a 25-pin female connector wired to appear as a data communication (Modem) device to the input equipment.
* The printer character set consists of the 64 upper-case ASCII characters.

SPECIFICATIONS

Input Connector	Qty. 1; 25-pin
Data Input Lines	1; Serial ASCII (RS-232-C)
Control Signals	DSR, DCD, CTS
Scan Capability	None
Character Set	64 Upper Case ASCII
Baud Rate	Switch selectable; 110, 150, 300, 600, 1200
Buffer Storage	32 characters

Table 13-3. Input Connector Pin Usage

PIN NO.	USE
2	BA - Transmitted Data
5	CTS - Clear To Send
6	DSR - Data Set Ready
7	AB - Signal Ground
8	DCD - Received Line Signal Detector

BAUD RATE SELECT

The baud rate must be set on S1 to correspond to the baud rate of the connected test instrument. S1 is located in the upper left hand corner of the -002 RS-232-C Interface board. Refer to Table 13-4 for the baud rate select switch settings.

Table 13-4. Baud Rate Selection; Switch S1

	110	150	300	600	1200
S1-1	Open/off	Open/off	Open/off	Closed/on	Open/off
S1-2	Open/off	Open/off	Closed/on	Open/off	Open/off
S1-3	Open/off	Closed/on	Open/off	Open/off	Open/off
S1-4	Closed/on	Open/off	Open/off	Open/off	Open/off
S1-5	Open/off	Open/off	Open/off	Open/off	Closed/on

NOTE: Switches will be labeled as ON/OFF or CLOSED/OPEN.

2020A-003 - IEEE-488 INTERFACE

FEATURES

* Interface Option -003 is an IEEE-488 interface logic network capable of accepting bit parallel, character-serial ASCII information from the IEEE-488 standard bus.

* Data may be accepted in either of two switch selectable modes:
  1) Listen only (S2 on)
  2) Addressable mode (S2 off)

* The character set consists of the standard 64 upper-case ASCII characters, plus special characters. See Table 13-5.

* All control and data information is exchanged through a 24-pin female connector.

* Plot mode is available for use. See the section at the end of the 2020A options section for plot mode programming limits.

SPECIFICATIONS

Input Connector	24-pin female
Signals	IEEE-488 1978 STD
Scan Capability	None
Plug Compatible	All other IEEE-488 1978 STD
Character Set	64 Upper case ASCII, plus special characters in Table 13-5.
IEEE Mode	Listen Only or Addressed Listen; Switch selectable
Buffer Storage	None

Table 13-5. Special Character Set

ASCII CODE		PRINTER CHARACTER
DECIMAL	HEX	
10	0A	(Line feed) Terminate input string
12	0C	Space one line (form feed)
16	10	Initiate plot mode
254	FE	Advance paper on dot location
255	FF	Terminate plot mode
100	64	Degree symbol (°)
102	66	Lower case f
107	6B	Lower case k
109	6D	Lower case m
110	6E	Lower case n
112	70	Lower case p
114	72	Ohms symbol
115	73	Lower case s
117	75	Micro Symbol
177	7A	Lower case z

SWITCH SETTINGS

The -003 requires that 2 switches be set.

1) S1, address select
2) Data mode select

Address Select

S1 sets the IEEE-488 (GPIB) address to which the 2020A will respond when addressed. S1 is located in the upper left corner of the -003 IEEE-488 Interface board. A list of possible addresses and their settings on S1 follows in Table 13-6.

S2 - Data Mode Select

S2 must be set to ON for LISTEN ONLY mode. S2 set to OFF allows ADDRESSED LISTEN mode. S2 is located next to S1 in the upper left hand corner of the -003 Interface board.

Table 13-6. Valid IEEE-488 Addresses

LISTEN ADDRESS		SWITCH S1 ADDRESSES ADDRESS SWITCH POSITION					COMMENTS
ASCII CHARACTER	ADDRESS	5	4	3	2	1	
SPACE	0	0	0	0	0	0	(1 = Closed)
!	1	0	0	0	0	1	(0 = Open)
"	2	0	0	0	1	0	
#	3	0	0	0	1	1	
$	4	0	0	1	0	0	
%	5	0	0	1	0	1	
&	6	0	0	1	1	0	
'	7	0	0	1	1	1	
(	8	0	1	0	0	0	
)	9	0	1	0	0	1	
*	10	0	1	0	1	0	
+	11	0	1	0	1	1	
,	12	0	1	1	0	0	
-	13	0	1	1	0	1	
.	14	0	1	1	1	0	
/	15	0	1	1	1	1	
0	16	1	0	0	0	0	
1	17	1	0	0	0	1	
2	18	1	0	0	1	0	
3	19	1	0	0	1	1	
4	20	1	0	1	0	0	
5	21	1	0	1	0	1	
6	22	1	0	1	1	0	
7	23	1	0	1	1	1	
8	24	1	1	0	0	0	
9	25	1	1	0	0	1	
:	26	1	1	0	1	0	
;	27	1	1	0	1	1	
<	28	1	1	1	0	0	
=	29	1	1	1	0	1	
>	30	1	1	1	1	0	
?	31	----------ILLEGAL----------					

Table 13-7. 2020A-003 Connector Pin Usage

INPUT CONNECTOR	MNEMONIC	SIGNAL DESCRIPTION
J6 - Pin 1	DIO1	Bit Parallel, Byte Serial Data: Bit 1
J6 - Pin 2	DIO2	Bit Parallel, Byte Serial Data: Bit 2
J6 - Pin 3	DIO3	Bit Parallel, Byte Serial Date: Bit 3
J6 - Pin 4	DIO4	Bit Parallel, Byte Serial Data: Bit 4
J6 - Pin 5	EOI	End or Identify; Not Used
J6 - Pin 6	DAV	Data Valid: from Bus Controller
J6 - Pin 7	NRFD	Not Ready for Data: from Interface
J6 - Pin 8	NDAC	Not Data Accepted: from Interface
J6 - Pin 9	IFC	Interface Clear: from Bus Controller
J6 - Pin 10	SRQ	Service Request: Not Used
J6 - Pin 11	ATN	Attention: from Bus Controller
J6 - Pin 12		
J6 - Pin 13	DIO5	Bit Parallel, Byte Serial Data: Bit 5
J6 - Pin 14	DIO6	Bit Parallel, Byte Serial Data: Bit 6
J6 - Pin 15	DIO7	Bit Parallel, Byte Serial Data: Bit 7
J6 - Pin 16	DIO8	Bit Parallel, Byte Serial Data: Bit 8
J6 - Pin 17	REN	Remote Enable: Not Used
J6 - Pin 18-24	-	Bussed to Digital COMMON

2020A-004 - PTI INTERFACE

FEATURES

The PTI Interface Option -004 is intended to accept data directly from other Fluke PTI instruments in either a BCD or ASCII format.

* Two data transfer modes can be used;

  1) handshake data transfer for Parallel ASCII format data
  2) clocked data transfer for BCD format data

* The interface can accept data from a maximum of nine addressable input instruments.

* It can scale all channels of a Model 2300A Scanner

* Communications with the PTI interface is through a 36-pin Amp ("Champ" series) male connector

  8 data lines
  4 address lines
  4 handshake lines

* The printer character set consist of the 64 upper case ASCII characters, plus 15 special characters. See Table 13-8.

SPECIFICATIONS

Connector	Male 36-pin Amp "Champ"
Input Signals	8 Data Lines
Output Signals	4 Addres Lines
Handshake Signals	ADRVL, SCNIP, DTACK, DTVL
Scan Capability	Maximum of 9 PTI Addressable instrument or all 2300A Scanner channels.
Annotation	Instrument address. (Elasped time only with Option -006).

Specifications, Cont.

Character Set	64 Upper case ASCII plus special characters. See Table 13-8.
Plug Compatible	7250A, 7260A, 7261A, 7220A Fluke Counters. 8600A, 8800A, 8920A Fluke DVM's. 2180A, 2190A Fluke Thermometers 2300A Scanner
Buffer Storage	One line.

Table 13-8. Special Printer Characters

ASCII CODE CHARACTER	PRINTER CHARACTER
Lower Case d	Degree Symbol (^{o})
Lower Case f	Lower Case f
Lower Case k	Lower Case k
Lower Case m	Lower Case m
Lower Case n	Lower Case n
Lower Case p	Lower Case p
Lower Case r	Omega Symbol (ohms)
Lower Case s	Lower Case s
Lower Case u	Micro Symbol (u)
Lower Case z	Lower Case z

ADDRESSING

The 2020A-004 Interface will respond to a test instrument using either handshaked parallel ASCII or clocked BCD, depending on the address transferred to the -004 option.

A list of the various acceptable addresses follows in Table 13-9. (Note: There are no switches to set on the 2020A-004 option.)

Table 13-9. PTI System Interface Addresses

ADDRESS		DATA FORMAT	INTERFACE MODE
BINARY	HEX		
0000	0	None	PTI System Reset
0001	1	Parallel ASCII	Handshake
0010	2	7250A,7260A,7261A W/521	Clocked
0011	3	7220A W/521 Option	Clocked
0100	4	8920A W/521 Option	Clocked
0101	5	8600A, 8800A W/521 Option	Clocked
0110	6	Parallel ASCII	Handshake
0111	7	Parallel ASCII	Handshake
1000	8	Parallel ASCII	Handshake
1001	9	Parallel ASCII	Handshake
1111	F	None	All Instruments Off

The data output format depends on which instrument is being used. Fluke temperature instruments use the handshaked Parallel ASCII data format, so addresses 1, 6, 7, 8, and 9 are all valid addresses. Consult the section in this guide corresponding to the connected test instrument.

2020A-005 - PARALLEL BCD INTERFACE

FEATURES

* The Option -005 is a Parallel BCD Interface for the Model 2020A Printer. The logic network accepts eleven 4-bit BCD words in character parallel format. The first seven 4 bit words are data input, the last 4 BCD words are annotation inputs. The BCD interface uses columns 10 through 20 or 9 through 20 of the 20 column printer format, depending on which method of decimal point assignment is used.

* Output triggers either positive true or negative true.

* Data ready for input signal either positive true or negative true.

SPECIFICATIONS

Connectors
Qty 1.-50 pin male.

Input Signals
11 Data Words, 4-bit BCD.
DOU Busy Line-- indicates Data Ready for Input.

Output Signals
Two trigger outputs, one positive true logic; one negative true logic.

Scan Capability
None

Character Set
Standard 64 ASCII upper case character set plus special characters.

Decimal Point
Jumper selection of either:
1) Fixed Decimal Point (switch selectable)
2) Remotely BCD Programmable Decimal Point

Standard Column Usage
Jumper selection of either:
1) 7 data + 4 annotation
2) 7 data + 3 annotation with BCD Programmable Decimal Point

Specifications, Cont.

Buffer Storage
One line.

Table 13-10. Parallel BCD Character Set

BINARY CODE	HEX CODE	BCD ANNOTATION				
		COL. 10-16	COL. 17	COL. 18	COL. 19	COL. 20
1111	F	Space	Space	Space	Space	Space
1110	E	.	m (milli)	A	D	C
1101	D	>	u (micro)	V	A	G
1100	C	<	n (nano)	s	L	B
1011	B	+	p (pico)	<ohm>	J	A
1010	A	-	f (femto)	S	K	Q
1001	9	9	k (kilo)	W	H	R
1000	8	8	M	H	z	U
0111	7	7	G	F	S	V
0110	6	6	k	/	s	W
0101	5	5	P	P	M	X
0100	4	4	I	N	*	Y
0011	3	3	F	T	0	Z
0010	2	2	R	M	P	E
0001	1	1	%	#	I	N
0000	0	0	^{o} (degree)	C	F	T

DECIMAL POINT POSITION SELECTION

A. A decimal point can be assigned by one of 2 ways:

1. Fixed decimal point (switch selectable S1).
2. Remote BCD programmable mode. A 4-bit code through connector J6 pins 28, 3, 27 and 2 will produce a column selectable decimal point.

B. Switch Selected Decimal Point

To have a fixed decimal point poisition, refer to Table 13-11 and set switch S1 to the appropriate value. S1 is located in the front righthand corner of the -005 Interface PCB.

Table 13-11. Switch S1, Decimal Point Position Selection

SWITCH S1				DECIMAL POINT COLUMN											
4	3	2	1	9	10	11	12	13	14	15	16	17	18	19	20
ON	ON	ON	ON	.	X	X	X	X	X	X	X	X	X	X	
ON	ON	ON	OFF	.	X	X	X	X	X	X	X	X	X	X	
ON	ON	OFF	ON	X	.	X	X	X	X	X	X	X	X	X	
ON	ON	OFF	OFF	X	X	.	X	X	X	X	X	X	X	X	
ON	OFF	ON	ON	X	X	X	.	X	X	X	X	X	X	X	
ON	OFF	ON	OFF	X	X	X	X	.	X	X	X	X	X	X	
ON	OFF	OFF	ON	X	X	X	X	X	.	X	X	X	X	X	
ON	OFF	OFF	OFF	X	X	X	X	X	X	.	X	X	X	X	
OFF	ON	ON	ON	X	X	X	X	X	X	X	.	X	X	X	
OFF	ON	ON	OFF	X	X	X	X	X	X	X	X	.	X	X	
OFF	ON	OFF	ON	X	X	X	X	X	X	X	X	X	.	X	
OFF	ON	OFF	OFF	X	X	X	X	X	X	X	X	X	X	.	
OFF	OFF	ON	ON	X	X	X	X	X	X	X	X	X	X	X	.
OFF	OFF	ON	OFF		X	X	X	X	X	X	X	X	X	X	X
Additional Switch Codes result in No Decimal Point Print															

C. BCD Programmable Decimal Point Position Select

1. Decimal point position can also be established by inputting a four-bit code through connector J6, pins 28, 3, 27, and 2. See Table 13-12.

2. A minor modification to the Parallel BCD Interface PCB is necessary.

   a. Remove the 10 kohm resistor network from PCB location Z22 and place it in location Z25. No soldering is necessary; the resistor network is socket mounted.

   b. All segments of Switch S1 must be OFF.

3. The decimal point position may now be programmed through the last input position using the codes from Table 13-12. Use of this method sacrifices the last (fourth) annotation character, which will print blank.

4. This method of programming the decimal point position is analagous to using Switch S1. Pin 2 of J6 is equivalent to segment S1; Pin 27 is equivalent to segment 2; Pin 3 is equivalent to segment 3; Pin 28 is equivalent to segment 4. A low logic level at a pin of J6 is equivalent to the ON position of S1.

Table 13-12. BCD Code, Decimal Point Position Selection

BCD CODE AT CONNECTOR PINS (J6)				DECIMAL POINT COLUMN											
28	3	27	2	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	.	X	X	X	X	X	X	X	X	X	X	
0	0	0	1	.	X	X	X	X	X	X	X	X	X	X	
0	0	1	0	X	.	X	X	X	X	X	X	X	X	X	
0	0	1	1	X	X	.	X	X	X	X	X	X	X	X	
0	1	0	0	X	X	X	.	X	X	X	X	X	X	X	
0	1	0	1	X	X	X	X	.	X	X	X	X	X	X	
0	1	1	0	X	X	X	X	X	.	X	X	X	X	X	
0	1	1	1	X	X	X	X	X	X	.	X	X	X	X	
1	0	0	0	X	X	X	X	X	X	X	.	X	X	X	
1	0	0	1	X	X	X	X	X	X	X	X	.	X	X	
1	0	1	0	X	X	X	X	X	X	X	X	X	.	X	
1	0	1	1	X	X	X	X	X	X	X	X	X	X	.	
1	1	0	0	X	X	X	X	X	X	X	X	X	X	X	.
1	1	0	1		X	X	X	X	X	X	X	X	X	X	X
Additional BCD codes result in no decimal point															

NOTE: If this method of decimal point select is used, the 10K resistor network must be removed from location Z22 and placed in location Z25. Then, all segments of switch S1 must be placed in OFF position.

TRIGGER

Some Parallel BCD test instruments will not take a new reading until specifically asked by some outside controlling device. For those instruments, the 2020A can provide a trigger output. Instruments requiring a logic high level to take a reading can use the Trigger(+) signal on pin 25 of J6. Instruments requiring a logic low level can use the Trigger(-) signal on pin 24 of J6.

BUSY SIGNAL JUMPER

Jumper selection of either positive-true or negative-true DOU busy signal operation is possible. This must be done prior to initial operation.

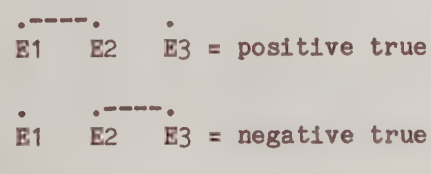
This signal is used to tell the 2020A when valid data is available for it to print. For example, the user would not want the 2020A to print data while the test device was busy loading information into its output registers. Then the data would be meaningless.

Some instruments will tell the 2020A not to print by outputting a logic high level. When using the 2020A with these instruments, install the jumper between points E1 and E2. The signal line will be found on pin 49 of J6.

Some instruments will tell the 2020A not to print by outputting a logic low level. When using the 2020A with these instruments, install the jumper between points E2 and E3. The signal line will still be found on pin 49.

See Figure 13-13. Jumper positions E1, E2, E3 are located on right half of board near central outer edge.

Figure 13-13. Busy Signal Jumper Selection



INPUT CONNECTOR PIN USAGE

Refer to Table 13-14 for input connector pin usage.

Table 13-14. Input Connector Pin Usage

CHARACTER	PIN NUMBERS				
	BIT 1	BIT 2	BIT 4	BIT 8	COLUMN
C1	22	47	23	48	**RMC
C2	20	45	21	46	
C3	18	43	19	44	
C4	16	41	17	42	
C5	14	39	15	40	
C6	12	37	13	38	
C7	10	35	11	36	
C8	8	33	9	34	
C9	6	31	7	32	
C10	4	29	5	30	
C11*	2	27	3	28	**LMC
TRIGGER (-)	24				
TRIGGER (+)	25				
DOU BUSY	49				
+5 V	50				
GND	1 & 26				

*OR decimal point if 10K resistor network is in Z25 position.
Any unused pins will be a "1."

**RMC= Right Most Character
LMC= Left Most Character

2020A-006 - INTERVAL TIMER

FEATURES

The Interval Timer Option - 2020A-006 provides for selection of fixed interval data printouts. There are 16 selectable print intervals, 10 seconds, 1 minute, 10 minutes, 1 hour and each multipliable by 1, 2, 4 or 8, allowing up to 10 seconds to 8 hours print intervals. See Table 13-15.

Table 13-15. Print Intervals

TIME	MULTIPLIER			
INTERVAL	X1	X2	X4	X8
10 SEC	10 SEC	20 SEC	40 SEC	80 SEC
1 MIN	1 MIN	2 MIN	4 MIN	8 MIN
10 MIN	10 MIN	20 MIN	40 MIN	80 MIN
1 HOUR	1 HOUR	2 HOURS	4 HOURS	8 HOURS

Only 1 interval, and 1 multiplier may be selected simultaneously. To terminate interval print mode, press the RESET key on front panel.

PRINTING AND PLOTTING WITH THE 2020A UNIVERSAL PRINTER

PRINTING

The 2020A will easily print any character in its valid character set as long as the ASCII representation of that character is sent to the printer. A print line must consist of no more than 20 characters. Any character beyond the twentieth, except a Line Feed (LF), will be deleted. The LF (ASCII decimal 10) is the terminator for the character string. When a LF is sent, the 2020A prints the line and then automatically advances one line. To advance additional lines, send ASCII Form Feed (FF, ASCII decimal 12). If ASCII carriage return, line feed is sent (CR LF) the 2020A will ignore the CR and respond only to the LF. The 2020A automatically right justifies all character strings.

Thus, to send data to be printed, use the following procedure:

1. Send the character string which is to be printed. This string should consist of no more than 20 characters represented in ASCII format.

2. After 20 characters have been printed (or less, if that is desired), send an ASCII LF. This terminates the first character string and advances the printer to the beginning of the next line.

3. If an additional line needs to be advanced send an ASCII FF.

4. Continue back to step 1 until all lines are printed.

PLOTTING

The 2020A can specifically address any of the 100 dots which makes up a print line. Each of these dots is assigned a binary value, with dots numbered 0 to 99. Dot number 0 prints on the left side of the paper, while dot number 99 prints on the right side of the paper.

In order to enter the Plot mode, ASCII decimal 16 (Control P) must be sent to the printer. After this, the 2020A will respond to the valid ASCII dot position codes (0-99) and ASCII decimal 254, advance one dot position. To print the dot the 2020A must see a string termination code, ASCII decimal 255. When ASCII 255 is recognized, the 2020A will print, paper advance (if sent), and exit plot mode. To continue plotting, the ASCII 16 plot initiate command must be sent along with dot position codes, paper advance and termination code for each dot line. NOTE: IT IS NOT RECOMMENDED THAT ROWS OF SOLID DOTS BE PRINTED, AS DAMAGE TO THE PRINTHEAD CAN OCCUR.

The procedure for plotting is thus:

1. Send ASCII decimal 16. This initiates the plot mode.

2. Send the values corresponding to the positions of up to 20 dots.

3. Send ASCII decimal 255 to terminate the dot position string, if no paper advance is desired. Return to step one to continue plotting additional dots on the same line.

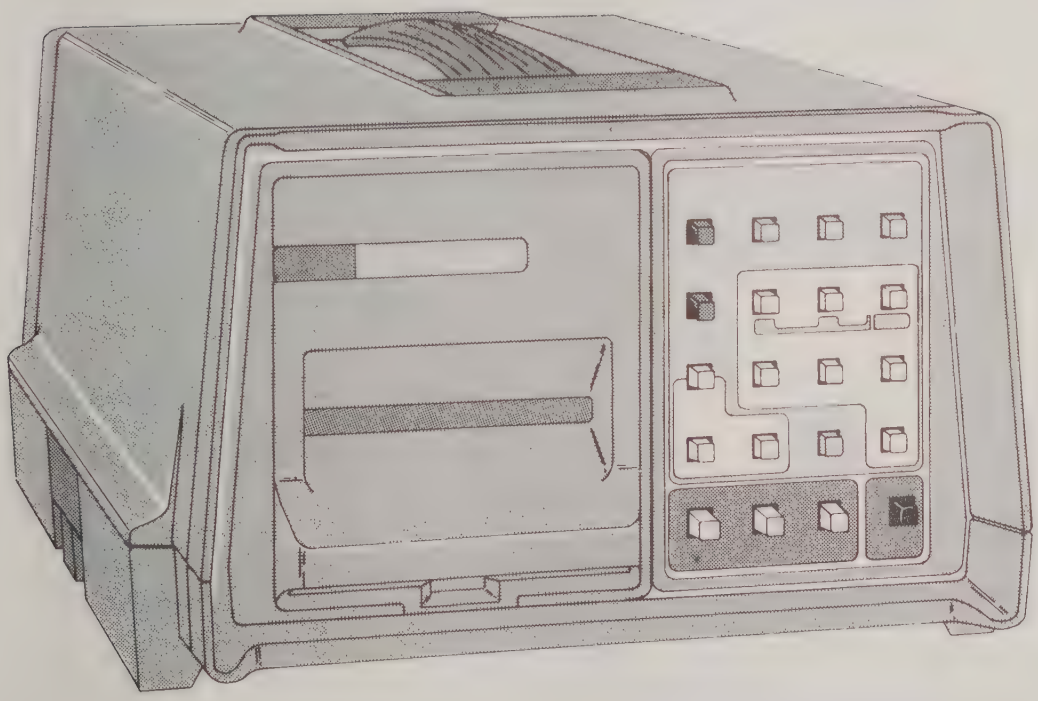
4. Send ASCII decimal 254, then ASCII decimal 255, to print the dot, advance the paper and terminate the string. Return to step one to continue plotting additional lines.

Examples of both printing and plotting programming follow.

EXAMPLE USING A FLUKE 1720A AND A 2020A PRINTER WITH AN IEEE INTERFACE

```
10!  chr$(10)= line feed
20!  chr$(12)= form feed
30!
40   PRINT @101%, "A PLOTTING PRINTER"; CHR$(10);
50   PRINT @101%, "THE 2020A BECOMES"; CHR$(10);
60   PRINT @101%, "WITH PROGRAMMING"; CHR$(10);
70   PRINT @101%, CHR$(12);
80!
90!  ASCII decimal 16= enter plot mode
100!              255= terminate dot string
110!              254= advance paper
120! This part of the program will print a diagonal row of dots beginning
     on the left side of the paper and continuing to the right.
130!
140  FOR I = 0-99
150       PRINT @101%, CHR$(16); CHR$(I);
                       CHR$(254); CHR$(255);
160  NEXT I
170  END
```

2030A
Programmable
Printer



2030A PROGRAMMABLE PRINTER

The 2030A is a programmable, computing, 20 column thermal printer which can be used with Fluke PTI interface instruments.

FEATURES

* PTI interface with a wide range of plug compatible instruments
* Multi-instrument scanning (up to 9)
* Time annotation - real, elasped, interval
* Time interval printing - any interval from 1 sec. to 99:59:59
* Header annotation - 6 digits of numeric data to identify test run, etc.
* Trace mode to give trend plots
  -- 60 dots per inch
  -- continuously or on interval specified
* Math mode - to give (delta), %(delta), and mx+b scaling
* Alarms - high and low alarm setpoints
  -- transitions into and out of alarm condition logged, with time and value
* Engineering units annotation - up to 4 alphanumeric characters
* 6 print modes
* Documented printer tapes
* All features standard

SPECIFICATIONS

OPERATING CHARACTERISTICS

Type	Thermal, 20-column
Character Set	64-Upper case ASCII plus special characters listed in Table 14-2.
Scan Capability	Maximum of nine instruments automatically (requires two Y2034 Interconnect Accessories).
Print Speed	Three lines per second
Scan Speed	Three instruments per second (maximum)
Line Spacing	Approximately 2.4 lines per cm (6 lines per inch)
Print Modes	Single, Continuous, Trace, Interval, Interval Trace, Interval Limit, Remote
Time Selection	Elasped Time (ET), Real Time (RT), Elasped Time-Interval (ET and IT), Real Time-Interval (RT and IT)

PROGRAMMABLE PARAMETERS

Time	6-digit Real Time (HR:MIN:SEC)
Interval	6-digit Interval Time (HR:MIN:SEC)
Header	6-digit Reference Number
Math	Scales one instrument's input data
A	6-digit constant used in Math and Trace modes
B	6-digit constant used in Math and Trace modes
HI LIM	6-digit high limit value
LO LIM	6-digit low limit value
SPEC ADR	1-digit special address
UNITS	4 alphanumeric characters, 2 or 3 digit code to select each character

CONTROLS, INDICATORS & CONNECTORS

Refer to Figure 14-1 and Table 14-1 for a description of the 2030A's controls, indicators, and connectors.

Figure 14-1. Controls, Indicators, and Connectors

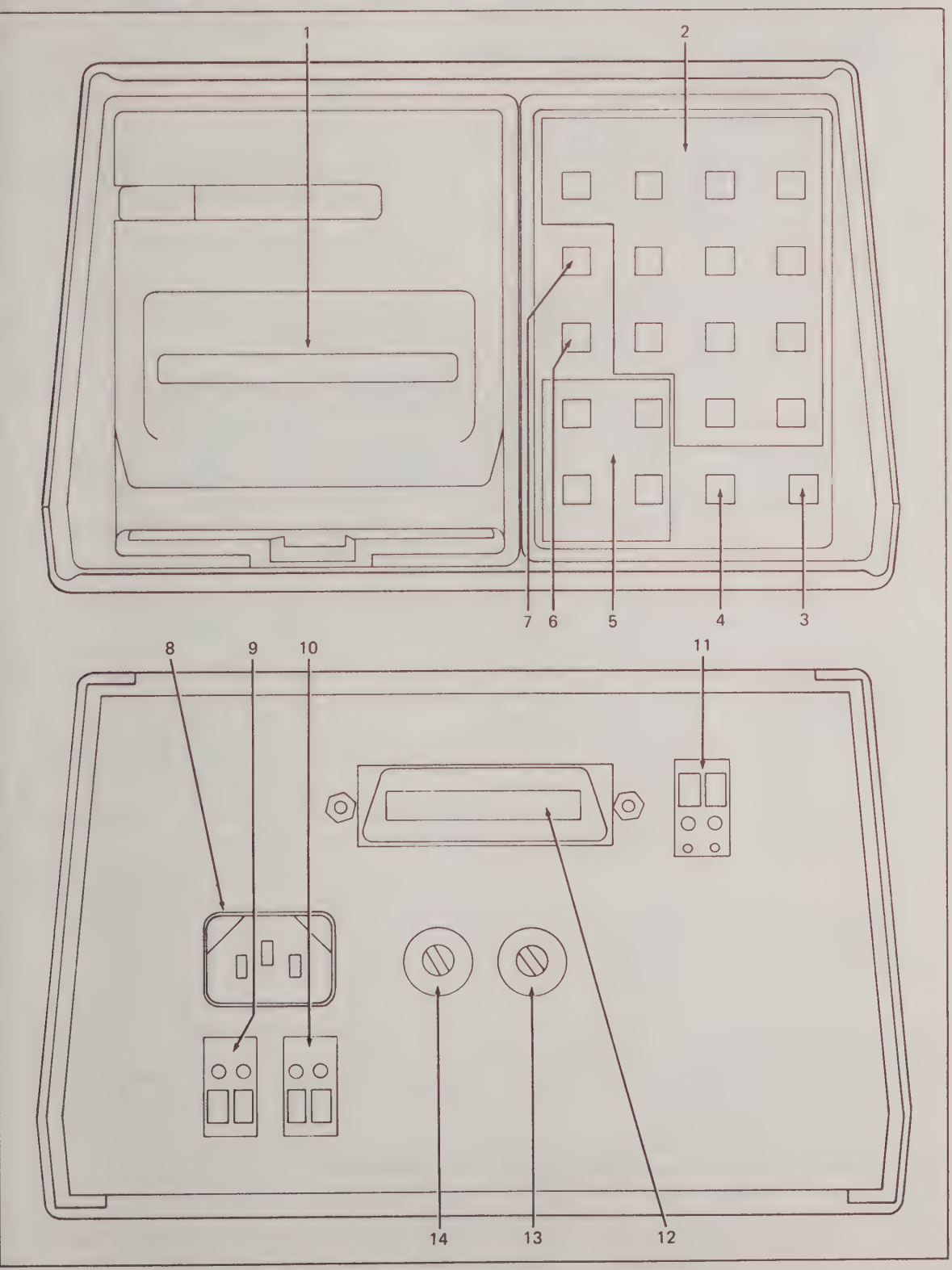


Table 14-1. Controls, Indicators, and Connectors.

Ref. No.	Name	Function
1	Print Unit	Twenty-column thermal line printer. Provides hard copy
2	PROGRAMMING Keys	Twelve keys used to program digits and select program operational functions. f: Function selection. Used to select operation functions. 7/TIME: Programs digit 7 or selects real TIME for programming. 8/INTERVAL: Programs digit 8 or selects INTERVAL time for programming. 9/HEADER: Programs digit 9 or selects HEADER number for programming. 4/A: Programs digit 4 or selects A constant for programming. 5/B: Programs digit 5 or selects B constant for programming. 6/MATH: Programs digit 6 or selects MATH function for programming. 1/HI LIM: Programs digit 1 or selects high limit for programming. 2/LO LIM: Programs digit 2 or selects low limit for programming. 3/UNITS: Programs digit 3 or selects annotation for programming. 0: Programs digit 0. -/SPEC ADR: Programs dash or minus (-) character or selects special address for programming.
3	POWER ON/OFF	Switches power to printer circuitry
4	PAPER ADVANCE	Advances print unit paper
5	PRINT Keys	Four switches used to establish PRINT mode.

Table 14-1. Controls, Indicators, and Connectors, Cont.

		CONT: Initiates continuous scan and print sequences until manually reset. SINGLE: Intiates a single scan and print sequence. TRACE: Initiates a trace of print dots using A and B constants to scale input data. INTERVAL: Initiates scan and print sequence at the time interval established by programming.
6	ENTER	Enters programmed value.
7	DECIMAL/STOP	Programs a decimal point or stops all PRINT modes except continuous.
8	LINE VOLTAGE CONNECTOR	3-prong line voltage connector.
9	AUX SUPPLY 12V dc	Connections for 12V external power input.
10	PRINT COMMAND	Connections for remote print input.
11	LIMITS	Connections for external alarm device.
12	DATA INPUT	Connection for input test instrument or Y2028 BCD to PTI converter.
13	F2	External 12V dc fuse
14	F1	Line ac fuse.

2030A PROGRAMMING

Programming is accomplished from the front panel using the numeric keys and the orange function [f] key which accesses those functions written in orange below the keys.

When the function key is pressed followed by an operation key, the currently programmed value (or default value) is printed. To change this value, simply input the proper value and press the ENTER key. The printer will then echo the input value in confirmation.

The 2030A has six print modes and nine print functions. The following is a description of the various modes and functions.

Each print mode description in this text will show

A. How to access mode
B. Printer function which must be set in order to use the print mode. To set the various print functions see the section following entitled PRINT FUNCTIONS.
C. Printer functions which optionally may be set by user. See the section entitled PRINT FUNCTIONS for a description of the functions and examples of application.
D. Any special notes or information regarding the print mode.

PRINT MODES

I. CONTINUOUS: Initiates continuous scan and print sequence of all connected test instruments until manually reset.

A. Press CONT button to initiate/terminate print mode.
B. Printer functions which must be set: NONE
C. Printer functions which optionally may be set:
1) Header
2) Math
3) Units
4) Time

II. SINGLE: Initiates single scan and print sequence of all connected instruments.

A. To set mode: Press SINGLE button
B. Functions which MUST be set: NONE
C. Functions which optionally may be set:
1) Header
2) Math
3) Units
4) Time

III. INTERVAL: Initiates scan and print sequence of all connected test instruments at the programmed time interval.

A. Set mode: Press INTERVAL key.
B. Printer functions which MUST be set:
1) Interval time
C. Printer functions which optionally may be set:
1) Header
2) Time
3) Math (plus A and B)
4) Units
D. Note: to exit INTERVAL print mode, press key [f], then [STOP].

IV. INTERVAL LIMIT: As in INTERVAL mode, except that in addition, instrument at selected address is monitored for out of limits conditions. When limit is reached, a special format printout is created and a relay closes.

A. To set mode: Press [f] key followed by [INT LIM] key.
B. Print functions which MUST be set:
   1) Interval time
   2) Low limit
   3) High limit
   4) Special address
C. Print functions which optionally may be set:
   1) Header
   2) Math (plus A and B)
   3) Time
   4) Units
D. Note: To exit INTERVAL LIMIT print mode, press key [f], then [STOP].

V. TRACE: Initiates a trace of print dots using programmed constants to scale input data from instrument at selected address. Trace is 100 dots wide. Dots are printed at 1 second intervals; event marker printed every sixtieth reading.

A. To set mode: Press [TRACE] key.
B. Printer functions which MUST be set:
   1) Special address
   2) A
   3) B
C. Printer functions which optionally may be set:
   1) Header
   2) Time
   3) Units
D. Note: To exit TRACE mode, press [f] key, then [STOP].

VI. INTERVAL TRACE: As in trace mode, but trace dots are printed only at programmed interval.

A. To set mode: Press key [f] followed by [INT TRACE] key.
B. Printer functions which MUST be set:
   1) Interval time
   2) Special address
   3) A
   4) B
C. Printer functions which optionally may be set:
   1) Header
   2) Time
   3) Units
D. Note: To exit INTERVAL TRACE mode, press key [f], then [STOP].

PRINT FUNCTIONS

The 2030A printer has 9 printer functions which either must be or may be set in any of the 6 print modes. To determine if one of these functions is required for the user's intended print mode, see the preceding section entitled PRINT MODES.

Each print function description in this text will contain the following information:

A. How to set function
B. Any special information regarding limitations of use.
C. Explanation of why used and example of use.

I. TIME: This function causes the 2030A to print either elapsed time (ET XX:XX:XX) or real time (RT XX:XX:XX). The 2030A's internal clock is not a time of day clock, however; it is a 0-100 hour clock.

A. To set function: Press key [f], followed by [TIME], then [time data (6 numbers)], then [ENTER].
B. Special information: Entering a time of "0" places the printer into the elapsed time mode. Entering any other time sets the real time mode.
C. The elapsed time mode is used when the important fact is when a given reading occurred in a test period. The real time mode is useful for knowing that a recorded event occurred at a given time. Remember, though, that the 2030A time clock is a 100 hour clock.

Example:
1) Set time to 6:35:00
a) Press [f] [TIME] [63500] [ENTER]

II. INTERVAL TIME: This function sets the time interval at which the printer will scan and print data from all instruments connected to it.

A. To set function: Press key [f], followed by [INTERVAL]. Then enter [6 (or less) digits of interval time data], followed by pressing [ENTER].
B. Special information: Intervals from 00:00:01 to 99:59:59 are possible. Used only in INTERVAL, INTERVAL LIMIT, and INTERVAL TRACE modes.
C. Use of the interval time function in conjunction with one of the interval print modes allows the user to limit the rate at which data is collected and printed.

Example: Scan and print data every 90 minutes.
Press [f] [INTERVAL] [13000] [ENTER]

(NOTE: 13000 = 1:30:00 = 90 minutes)

III. HEADER: 6 digit numeric code programmable by user.

A. To set function: Press keys [f] [HEADER], then [6 or less digits of header information], then [ENTER].
B. Special information: NONE

C. The header number can be used for a test number, lot number, day code, or any other test information.

Example: Set header number to correspond to date 11/6/84.
Press: [f] [110684] [ENTER]

IV. UNITS: Up to 4 characters of special annotation may be printed in the four right hand printer columns. Units apply to the instrument connected at the special address programmed.

A. To set function: Press [f] [UNITS], then [code of desired character], followed by [ENTER]. Up to four special annotation characters can be chained together by using the - (minus sign).

B. Special information:

1. Units code set
   Refer to Table 14-2 for a listing of the 2030A's valid character set.
2. The units function will be applied only to the instrument connected at the special address. The special address function MUST be set for the units function to be invoked. See SPECIAL ADDRESS function, this section.
3. In order to reset the units (i.e., clear them), press [f] [UNITS] [0] [ENTER]. The 2030A will now indicate UNITS RESET.

C. Example: Program units to read BTU

1. Look at Table 14-2 to determine the code corresponding to the desired characters.

2. Press [f] [UNITS] [66-84-85] [ENTER]

3. Verify that the 2030A responds with UN BTU.

Table 14-2. 2030A Valid Characters

CODE	CHAR	CODE	CHAR
32	SP	69	E
33	!	70	F
34	"	71	G
35	#	72	H
36	$	73	I
37	%	74	J
38	&	75	K
39	'	76	L
40	(	77	M
41	)	78	N
42	*	79	O
43	+	80	P
44	,	81	Q
45	-	82	R
46	.	83	S
47	/	84	T
48	0	85	U
49	1	86	V
50	2	87	W
51	3	88	X
52	4	89	Y
53	5	90	Z
54	6	91	[
55	7	92	\
56	8	93	]
57	9	94	^
58	:	95	
59	;	100	$\overline{o}$ (degree)
60	<	102	f
61	=	107	k
62	>	109	m
63	?	110	n
64	@	112	p
65	A	114	(ohms)
66	B	115	s
67	C	117	u (micro)
68	D	122	z

V. HI LIMIT: Enters the high limit against which all data will be compared. If the data is higher than the high limit, a special format printout will result and a relay will close.

A. To set function: [f] [HI LIM], [six or less digits of high limit], followed by [ENTER].

B. Special information:
   1) Enter the high limit just as it would appear on the display of the test instrument, but ignore the position of the decimal point. See example.
   2) The high limit applies only in the INTERVAL LIMIT print mode.
   3) The high limit comparison occurs only with the test instrument connected at the special address. Therefore, the SPEC ADR function must be set
   4) A negative sign (-) may be used before the high limit value, if that high limit is to be a negative value.

C. Example: In monitoring a process, the highest temperature to be allowed before sounding an alarm is 130°F.
   1) Using a Fluke 2190A Digital Thermometer this would be displayed as 130.0°F. Therefore, set a high limit of 130.0°F: Press [f] [HI LIM] [1300] [ENTER]
   2) Using a Fluke 2180A Digital Thermometer, the displayed temperature is 130.00°F. To set a high limit: Press [f] [HI LIM] [13000] [ENTER]

VI. LO LIMIT: Exactly as in HI LIMIT, except that to set function press [f] [LO LIM], [six or less digits of low limit], followed by [ENTER].

Examples and special information are as in High Limit, but substitute the words "LO LIMIT" for "HI LIMIT" everywhere.

VII. SPECIAL ADDRESS: This is the address of the test instrument to which the 2030A will apply the math, limits, and units functions, as well as the trace print modes.

A. To set function: Press [f] [SPEC ADR], [single digit denoting the address], then [ENTER].

B. Special information:
   1. The SPEC ADR should correspond to the test instrument's address setting. See the appropriate test instrument manual or section within this guide to determine how to set this address.
   2. To disable the special address function, press [f] [SPEC ADR] [0] [ENTER].
   3. This function is required to be set for various print modes and functions.

C. Example: A 2300A Scanner is set to address 6 and the user wishes to use the interval limit print mode.
   Press [f] [SPEC ADR] [6] [ENTER]

VIII. MATH: The MATH function causes the data incoming at the special address to be scaled using the operator-entered constants A & B. The master equation is P=A(D*-B) where
P = printed value
A and B = user defined constants
D* = value as displayed on test instrument, ignoring decimal place. (70.0 => 700)

A. To set function: Press [f] [MATH]. The 2030A should respond with MATH SET, indicating that the math equation will now be used on the incoming data.

B. Special information:

1. To use the math function requires that the A and B constants be chosen and set. See the section following regarding the selection of A and B values.
2. The math equation is applied only to the instrument at the special address. Therefore, the special address function must be set.
3. To reset or clear the math function simply press [f] [MATH] again. The 2030A will respond with MATH RESET, indicating that the math equation will NOT be applied to incoming data.

C. Example: After determining the A and B constants' values, and setting the SPEC ADR, a user wishes to apply the math equation.
Press [f] [MATH]

IX. A and B: These are two user-determined constants which are used for scaling incoming data in the math function using the master equation P = A(D* - B), or for setting the trace edge limits in the trace and interval trace modes.

A. To set function: (Program A:) Press [f] [A], [six digit floating point value], [ENTER]; (Program B:) [f] [B], [six digit whole number with negative sign (if necessary)], [ENTER].

B. Special information:

1. The A constant has a 6-digit floating point format. If using the trace or interval trace modes, the A constant must have no more than 4 places to the right of the decimal place.

2. The B constant must be a whole integer, but may be made negative by pressing the (-) sign anytime before pressing ENTER.

3. The choice of values for the constants A and B can be determined by choosing the appropriate equation from the math operations Table 14-3. Examples for all of the equations are given.

4. Note: Math function equation errors may be induced by rounding off the A and B constants to the required six figures. These errors may be calculated as percentages of the printed value as detailed in Table 14-4. In calculating A constant round-off errors, the number of digits to the left of the decimal point (m) will always equal 4 in any trace mode calculation. In error calculation for deviation or percent deviation scaling, the highest printed value (Ph) is the highest expected deviation, or the highest expected percent of deviation. An error induced by the B constant is possible only if the lowest printed value (Pl) is not equal to zero.

Table 14-3. Math Operations

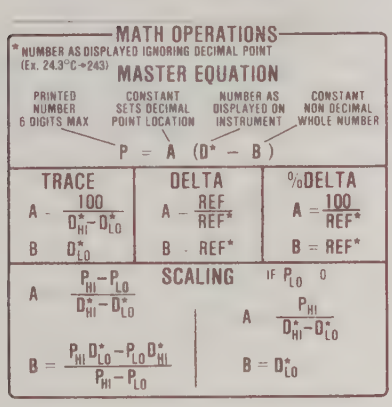

MATH OPERATIONS
* NUMBER AS DISPLAYED IGNORING DECIMAL POINT
(Ex. 24.3°C→243)
MASTER EQUATION
PRINTED NUMBER 6 DIGITS MAX
CONSTANT SETS DECIMAL POINT LOCATION
NUMBER AS DISPLAYED ON INSTRUMENT
CONSTANT NON DECIMAL WHOLE NUMBER
P = A (D* − B)
TRACE
A = 100 / (D*HI − D*LO)
B = D*LO
DELTA
A = REF / REF*
B = REF*
%DELTA
A = 100 / REF*
B = REF*
SCALING
IF PLO 0
A = (PHI − PLO) / (D*HI − D*LO)
B = (PHI D*LO − PLO D*HI) / (PHI − PLO)
A = PHI / (D*HI − D*LO)
B = D*LO

Table 14-4. Math Error Calculations

MATH FUNCTION ERROR CALCULATION

Percent error in P due to round-off error in constant A equals:

$$\frac{V-W}{A\ \text{calculated}} \quad 100$$

CONSTANT A ERROR

A Calculated: result of appropriate formula from Table 14-3
m: 6 minus number of digits to the left of the decimal point in the highest printed value.
V: A Calculated $X10^{m}$
W: nearest whole number to V
For proper decimal point placement, enter A constant= $\frac{W}{10^{m}}$

Table 14-4. Math Error Calculations, Cont.

CONSTANT B ERROR	Percent error in P due to round-off error in constant B equals: $\frac{\text{B constant - B calculated}}{\text{D* - B calculated}} \times 100$ B Calculated: result of appropriate formula from Table 14-3. B Constant: nearest whole number to B Calculated. D*: Display value ignoring decimal point.

C. Examples: The "*" indicates that the user is to ignore the position of the decimal point and enter the number. Remember, to apply the math equation to the incoming data requires that the MATH function be set and the SPEC ADR function be set.

1. DELTA: The user is interested in knowing how far an experiment is varying from the desired 110°. A Fluke 2190A is being used which would display the temperature as 110.0°.

   a. The equations are:

   DELTA EQUATION:

   $$A = \frac{REF}{REF^*}$$

   $$B = REF^*$$

   Solving: $A = \frac{110}{1100} = .1$

   $$B = 1100$$

   Substituting A and B back into the master math equation should check the validity of the values.

2. % DELTA: The user needs to know how far a process is varying on a percentage basis from the nominal reference temperature of 250°F. A Fluke 2180A RTD Digital Thermometer is being used which has .01° resolution and thus reads the reference temperature as 250.00°F.

   The % Delta equation is:

   % DELTA EQUATION:

   $$A = \frac{100}{REF^*}$$

   $$B = REF^*$$

$$A = \frac{100}{25000} = .004$$

$$B = 25000$$

3. SCALING EQUATION: (Note: Only linear scaling is possible [mx+b] with the 2030A)

A user is performing an experiment and would like to measure absolute temperature in degrees Kelvin. On this scale $0^{\circ}C$ => $273^{\circ}K$ and $100^{\circ}C$ => $373^{\circ}K$. A 2190A with 0.0° resolution is being used. What are the A and B constants?

The equation is:

SCALING EQUATION:

$$A = \frac{P_{HI} - P_{LO}}{D_{HI^*} - D_{LO^*}}$$

$$B = \frac{P_{HI} D_{LO^*} - P_{LO} D_{HI^*}}{P_{HI} - P_{LO}}$$

where:

$P_{hi} = 373$
$P_{lo} = 273$
$D_{hi} = 100.0$ => $D_{hi^*} = 1000$
$D_{lo} = 0.0$ => $D_{lo^*} = 0$

substituting:

$$A = \frac{(373)-(273)}{1000-0} = 0.1$$

$$B = \frac{(373)(0)-(273)(1000)}{373-273} = -2730$$

For the special case where $P_{lo} = 0$ is true, the following simplified equations hold:

SCALING EQUATION, $P_{LO} = 0$:

$$A = \frac{P_{HI}}{D_{HI^*} - D_{LO^*}}$$

$$B = D_{LO^*}$$

Other examples of scaling include converting from $^{\circ}C$ to $^{\circ}F$, $^{\circ}F$ to $^{\circ}R$, etc.

4. The A and B constants are also used to set the right and left edges for the trace and interval trace mode. The constant A sets the span, while B sets the lower edge.

The user wishes to monitor the temperature in a room and plot the trend information. It is expected that the temperature will stay between 70.0°F and 80.0°F.

TRACE EQUATION

TRACE EQUATION:

$$A = \frac{100}{D_{HI^*} - D_{LO^*}}$$

$$B = D_{LO^*}$$

Substituting:

$$A = \frac{100}{800-700} = 1$$

$$B = 700$$

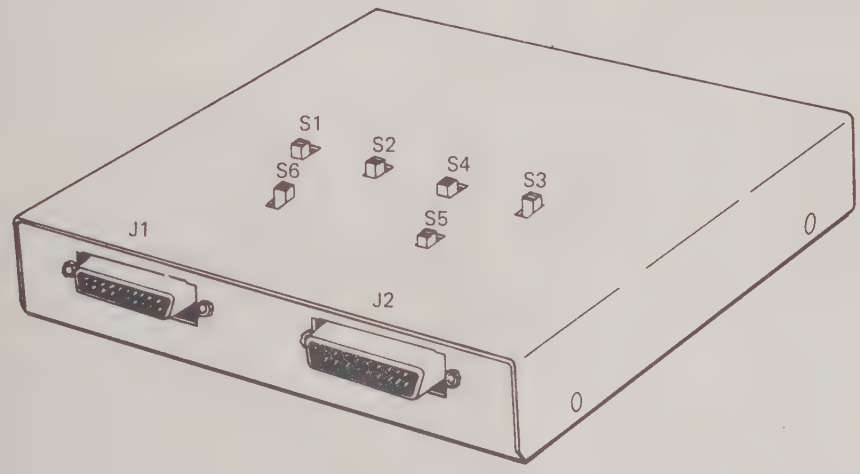
If the temperature should fall outside of the 70 to 80 degree range, the 2030A will stop the plot, print the data and proceed no further until the incoming data falls back within the programmed range.

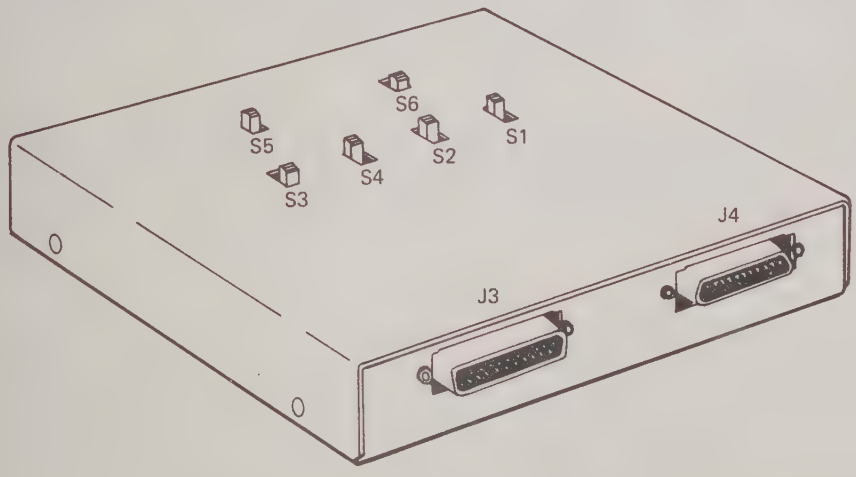
In the trace mode, constant A must have no more than 4 digits to the right of the decimal point.

PROGRAM PROMPTING

Each 2030A Computing Printer is shipped with a programming prompting card. It is designed as a convenient reference to be used by 2030A owners after they have read the section in this manual concerning programming. See Figure 14-2.

Figure 17-17. Connector and Switch Locations





INSTRUMENT ADDRESSING

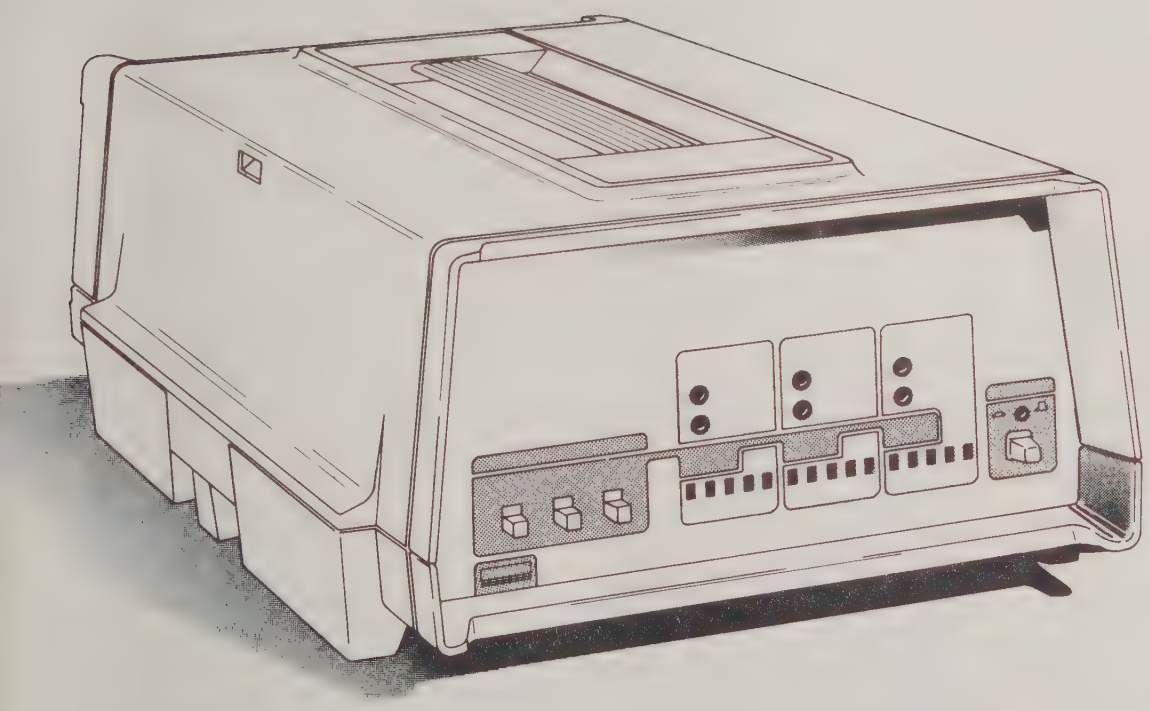
The 2030A printer is designed to interface with other Fluke instruments. Table 14-5 shows the instrument which can be used at a given address. Addresses 7, 8, 9 can be used with any instrument by simply setting S1, S2 & S3, respectively, to the format required by the test instrument. For example, using a 7250A at address 7 requires that S1 on the interface board in the 2030A be set to '2.'

Table 14-5. PTI System Interface Addresses

ADDRESS		DATA FORMAT	INTERFACE MODE
BINARY	HEX		
0000	0	None	PTI System Reset
0001	1	Parallel ASCII	Handshake
0010	2	7250A,7260A,7261A W/521	Clocked
0011	3	7220A W/521 Option	Clocked
0100	4	8920A W/521 Option	Clocked
0101	5	8600A, 8800A W/521 Option	Clocked
0110	6	Parallel ASCII	Handshake
0111	7	*Parallel ASCII	Handshake
1000	8	*Parallel ASCII	Handshake
1001	9	*Parallel ASCII	Handshake
1111	F	None	All Instruments Off

*Data format/ interface modes are selectable on these addresses.

1120A
IEEE-488 Translator



1120A IEEE-488 TRANSLATOR

FEATURES

- Interfaces Fluke measurement devices to IEEE-488 bus
- Designed in accordance with IEEE Standard Digital Interface for Programmable Instrumentation published by IEEE
- Accepts up to 3 interface boards

SPECIFICATIONS

Operating Power

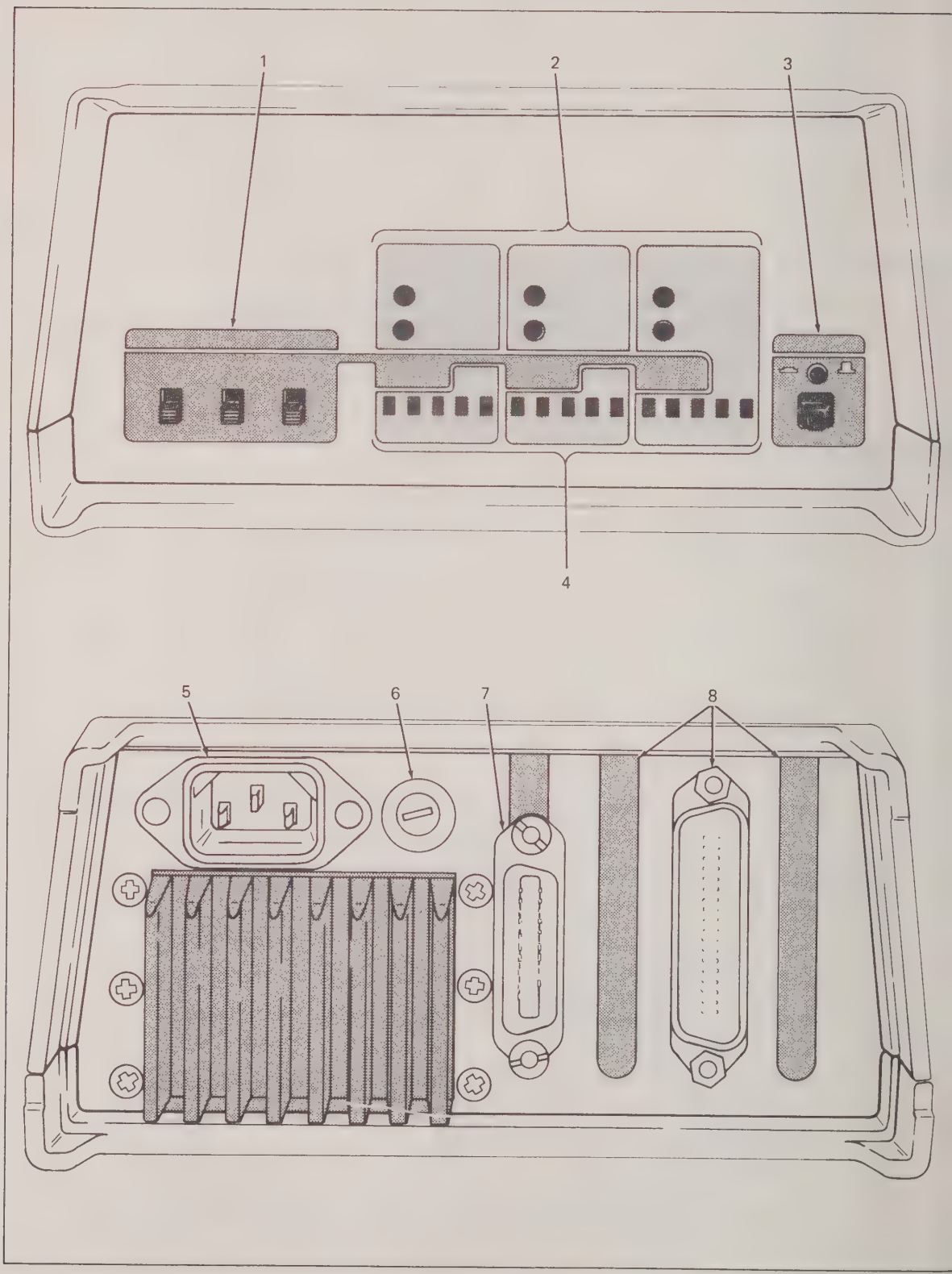
Input Voltage	Frequency
100V 120V 220V 240V	47-63 Hz
Input Power:	22.3W maximum

Interface Functions

The 1120A will support the following IEEE-488 Interface Functions:

INTERFACE FUNCTION	SYMBOL	CAPABILITY
Source Handshake	SH	FULL
Acceptor Handshake	AH	FULL
Talker or Extended Talker	T or TE	FULL
Listener or Extended Listener	L or LE	FULL
Service Request	SR	FULL
Remote Local	RL	FULL
Parallel Poll	PP	PPO
Device Clear	DC	FULL
Device Trigger	DT	FULL
Controller	C	CO

Figure 15-1. Controls, Indicators, and Connectors



CONTROLS, INDICATORS AND CONNECTORS

Refer to Figure 15-1 and Table 15-1 for a description of the 1120A's controls, indicators, and connectors.

Table 15-1. 1120A Controls, Indicators, and Connectors

REF NO.	NAME	FUNCTION
1	ADDRESS SELECT	Three switches select the three most significant bits of the IEEE bus address.
2	TALK/LISTEN Indicators	Provide LED indication of talk or listen status for each of the three interface positions.
3	POWER Switch	Push ON, push STBY.
4	Position Bits	Indicates the two least significant bits of the IEEE address for each Interface PCB Assembly.
5	Power Connector	Three-prong connector accepting line cord with ground wire.
6	Line Fuse	Use AGC 1/4A for 100 or 20V, AGC 1/8A for 220 or 240V.
7	IEEE-488 Connector	Accepts standard IEEE-488, 24-pin connector with metric screw tighteners.
8	Instrument Connector	Accepts 36-pin connector for interfacing measurement instrument.

The 1120A requires the proper personality card to interface to the right test instrument. Up to 3 different personality cards can be used. The correct card for use with Fluke temperature measurement instrumentation is the 2XXXA-522 IEEE-488 Interface Assembly.

ADDRESSING

In order to set the address to which an IEEE Controller will send its commands to the 1120A, set the front panel switches per Table 15-2. The two least significant digits are determined by which slot the personality card is placed. (Facing the front of the 1120A, 0/0 corresponds to leftmost PCB slot, 0/1 corresponds to center slot, and 1/0 corresponds to rightmost).

For example, if it is desired to have the IEEE controller in use send commands to address 17, the following switches would be set (in accordance with Table 15-2) A5 = 1, A4 = 0, and the personality card would be placed in the center slot (which corresponds to A2 = 0, A1 = 1).

Table 15-2. IEEE-488 Address Selection Codes

Decimal Number Address	Equivalent ASCII Character		Primary IEEE Address					PCB Position* 1=Leftmost 2=Middle 3=Rightmost
			Front Panel Switches			Determined by PCB Position		
	Talk	Listen	A5	A4	A3	A2	A1	
0	@	SP	0	0	0	0	0	1
1	A	!				0	1	2
2	B	"				1	0	3
4	D	S	0	0	1	0	0	1
5	E	%				0	1	2
6	F	&				1	0	3
8	H	(	0	1	0	0	0	1
9	I	)				0	1	2
10	J	*				1	0	3
12	L	'	0	1	1	0	0	1
13	M	_				0	1	2
14	N	.				1	0	3
16	P	0	1	0	0	0	0	1
17	Q	1				0	1	2
18	R	2				1	0	3
20	T	4	1	0	1	0	0	1
21	U	5				0	1	2
22	V	6				1	0	3
24	X	8	1	1	0	0	0	1
25	Y	9				0	1	2
26	Z	:				1	0	3
28	\	<	1	1	1	0	0	1
29	]	=				0	1	2
30	^	>				1	0	3

*PCB position is defined from an observer facing the front of the 1120A.

FUSE REPLACEMENT

WARNING: DISCONNECT THE UNIT FROM LINE POWER BEFORE ATTEMPTING FUSE REPLACEMENT.

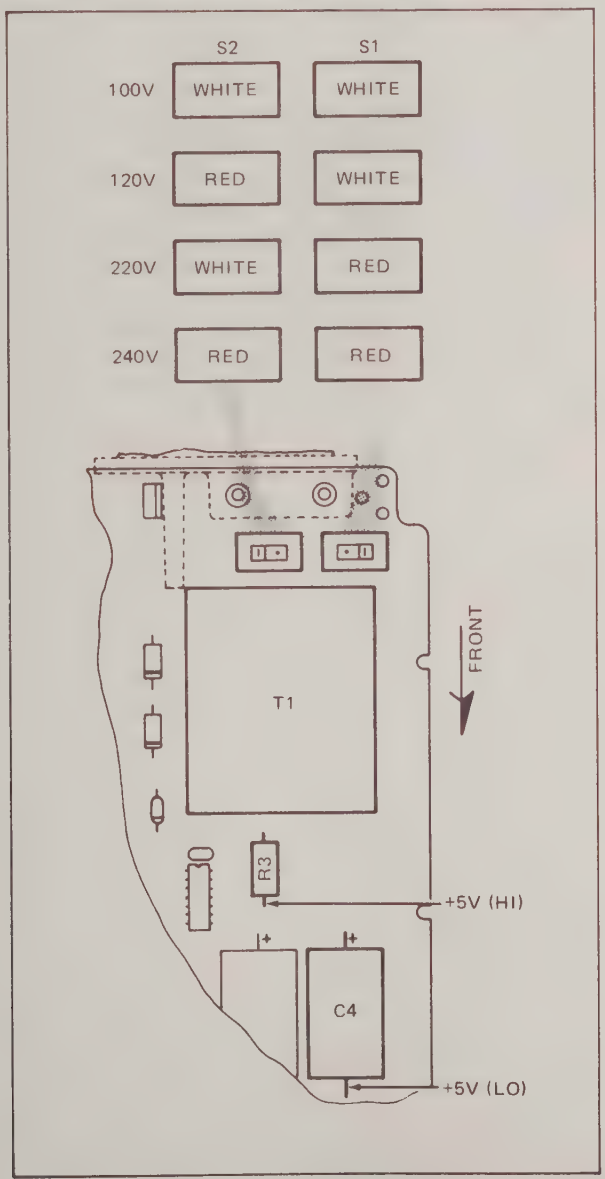
The 1120A has one fuse, accessible on the rear panel. Fuse values, depending on line voltage, are as follows:

VOLTAGE	FUSE
100V	AGC 1/4A
120V	AGC 1/4A
220V	AGC 1/8A
240V	AGC 1/8A

LINE VOLTAGE SWITCHING

Refer to Figure 15-2 regarding line voltage switch locations and settings.

Figure 15-2. Line Voltage Settings



1120A
Personality Cards

2XXXA-522 IEEE INTERFACE ASSEMBLY

FEATURES

The -522 IEEE Interface Assembly is the personality card used when interfacing a 2180A, 2190A or 2300A to an IEEE-488 device. The -522 card accepts the RS-232 data format being outputted from either the -002 Output option installed in the 2180A or 2190A or the -005 or -006 option in the 2300A, and transforms it to the IEEE-488 format. The interface may be addressed as a talker or a listener.

SPECIFICATIONS

Operating Power
+5 volts ±10%

Operating Temperature
0-50°C ambient

IEEE-488 Interface Functions Implemented:

SH1	Source Handshake	Full capacity
AH1	Acceptor Handshake	Full capacity
T6	Talker	Serial poll, not talk only
L4	Listener	Not listen only (See Note)
SR1	Service Request	Full capability

NOTE: The L4 Listener function signifies that the thermometer IEEE-488 Bus Interface has the same 5 digit talk and listen addresses and that the receipt of a listen address will unaddress the talk address. The Models 2180A and 2190A Thermometers do not accept any data in the listen mode and are not remotely programmable.

SWITCH SETTINGS

SRQ Mode

There are 2 switches which must be set in order to determine the SRQ mode, S1 and S2. Their locations are shown in Figure 16-1. Refer to Table 16-1 for the SRQ mode selection codes.

Figure 16-1. SRQ Mode Switches S1 and S2 Locations

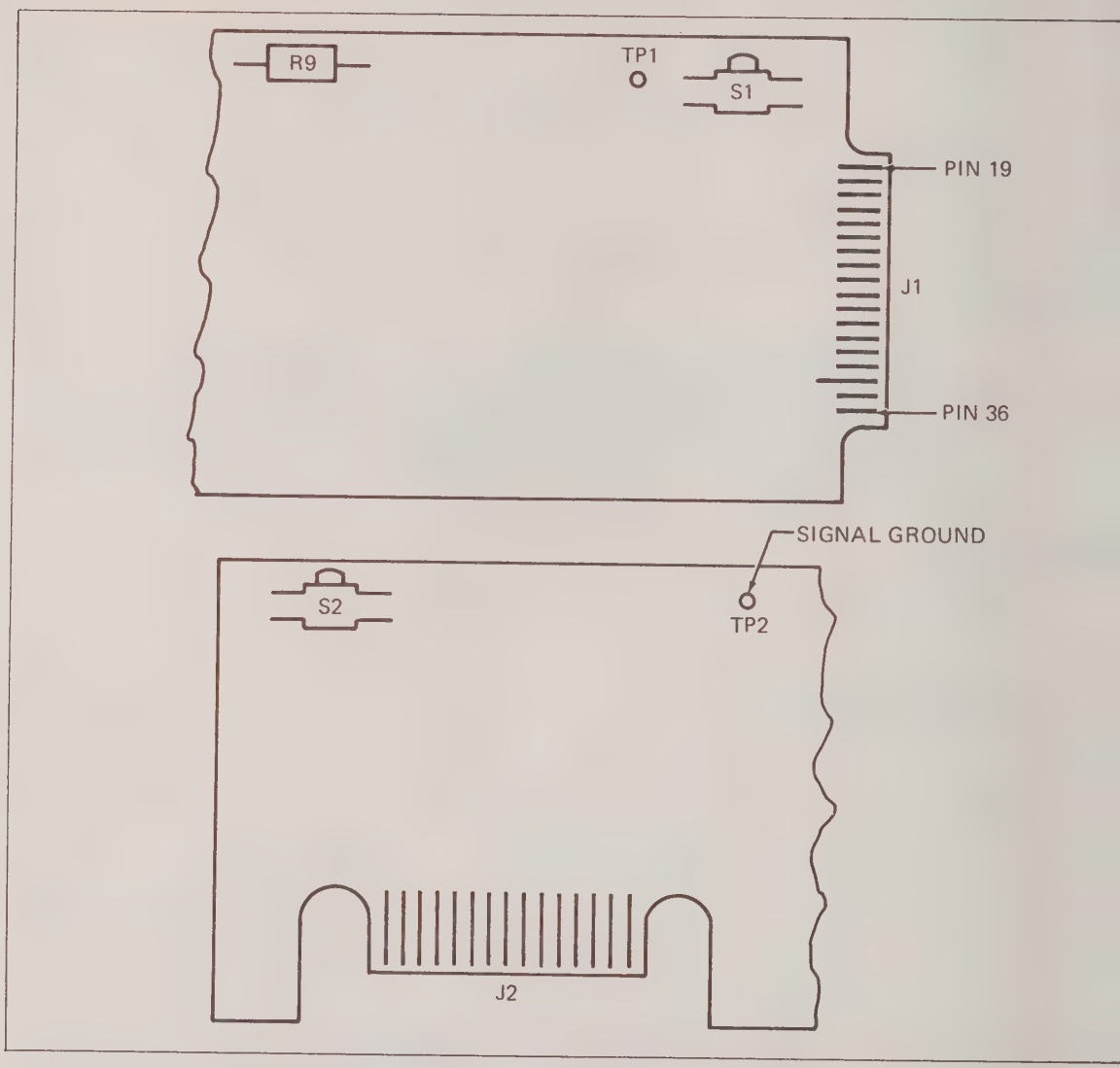


Table 16-1. SRQ Mode Selection Codes

SWITCH S1	SWITCH S2	EFFECT	SERIAL POLL RESPONSE BITS
ON	OFF	SRQ on Line Feed (LF character)	DB0 = 1 DB1 = 0
OFF	ON	SRQ on Buffer Full	DB0 = 0 DB1 = 1
ON	ON	SRQ on either LF or Buffer Full**	DB0 = 1 DB1 = 1
OFF	OFF	No SRQ	DB0 = 0 DB1 = 0

**This setting is used most commonly

ADDRESSING

1. Each PCB Assembly within the 1120A can be assigned a unique IEEE-488 address. This 5 bit address is assigned by the front panel switches (A3, A4, A5) in combination with the position of the Interface PCB Assembly within the 1120A (A1, A2). The leftmost position will have the lower two bits of 0-0, the center position will have bits of 0-1, and the rightmost position will have bits 1-0.

   The user must set switches A3, A4, and A5 to correspond to the desired IEEE address. For example, IEEE address 9 would be set by placing the -522 card in the center slot and setting A5 = 0, A4 = 1, and A3 = 0 on the front panel.

GENERAL INFORMATION

1. NOTE: The PTI test instrument connected to the 1120A must have its baud rate select switch set to 2400 baud.

2. System Connections

   Refer to Figure 18-12 and Case 9, for typical system connections.

3. Programming Example.

   The program shown in Figure 16-2 may be used as an example using the HP9825A as a controller.

Figure 16-2. Sample Program

```
0: dim A$[5]
1: dim B$[7]
2: ent "enter
 characters: ",A$
3: wrt 700,A$
4: wait 1000
5: red 700,B$
6: dsp "characte
 rs were",B$
7: wait 2000
8: gto 2
9: end
*26598
```

Line 1

B$ has been dimensioned 2 larger A$ because the 9825A automatically adds 2 characters (CR and LF) to A$.

Line 3,5

The 1120A's IEEE Address is 00.

Line 2

Upon appearance of "enter characters" prompt, enter a command, then press the continue key.

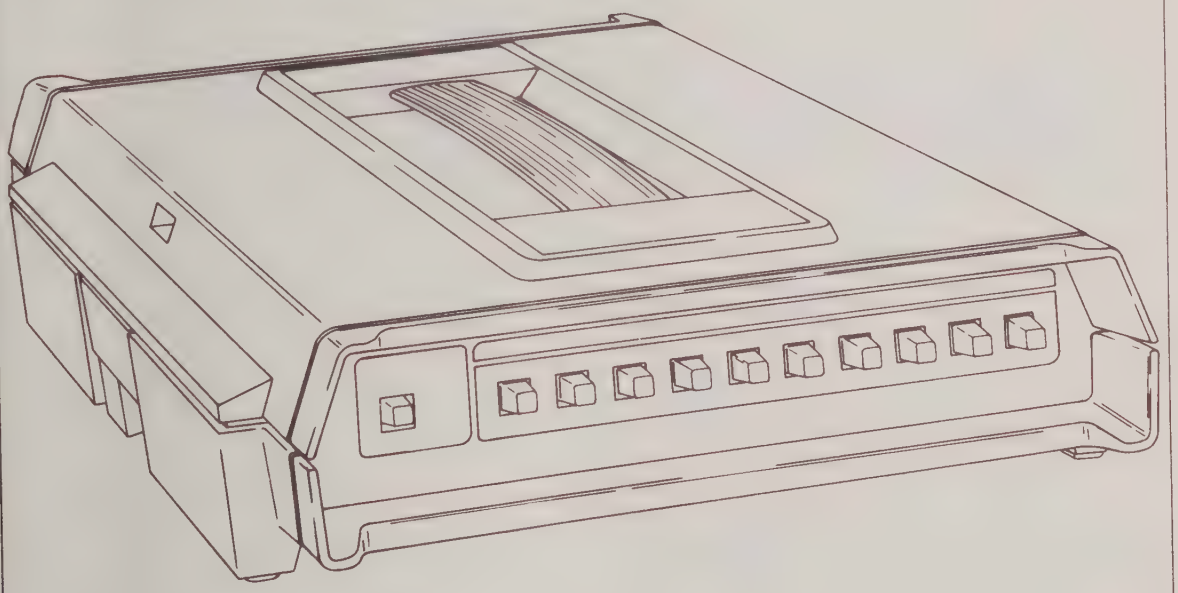
Line 6

If the test is a success, "Characters were" will appear as a prompt followed by the characters entered;

Table 16-2. Connector Pin/Signal Assignments

SIGNAL GROUP	JACK AND PIN	MNEMONIC	SIGNAL NAME	CLASS	COMMENTS
RS-232-C SIGNALS	J1-26	RX	Receive Data	Data	Input
	-28	SCB	Scanner Ready	Control	Input
	-29	DTR	Data Terminal Ready	Control	Input
	-30	TX	Transmit Data	Data	Output
	-31	RTS	Request to Send	Control	Input
	-32	CTS	Clear to Send	Control	Output
	-33	DSR	Data Set Ready	Control	Input (Not Used)
	-34	GND	Ground	Ground	Signal ground
1120A INTERNAL SIGNALS	J2-1	TALK	Talk	Status	Output
	-2	LISTEN	Listen	Status	Output
	-3	+5V	+5 volts	Power	—
	-4	+5V	+5 volts	Power	—
IEEE-488 BUS	-5	RFD	Ready For Data	Byte Transfer	Bidirectional
	-6	IFC	Interface Clear	Bus Management	Input
	-7	DAC	Data Accepted	Byte Transfer	Bidirectional
	-8	REN	Remote Enable	Bus Management	Input
	-9	DAV	Data Valid	Byte Transfer	Bidirectional
	-10	SRQ	Service Request	Bus Management	Output
	-11	EOI	End or Identify	Bus Management	Bidirectional
	-12	ATN	Attention	Bus Management	Input
	-13	DI08	Data Bit 8	Data	Bidirectional
	-14	DI07	Data Bit 7	Data	Bidirectional
	-15	DI06	Data Bit 6	Data	Bidirectional
	-16	DI05	Data Bit 5	Data	Bidirectional
	-17	DI04	Data Bit 4	Data	Bidirectional
	-18	DI03	Data Bit 3	Data	Bidirectional
	-19	DI02	Data Bit 2	Data	Bidirectional
	-20	DI01	Data Bit 1	Data	Bidirectional
1120A INTERNAL SIGNALS	-21	DB2	Data Bus Bit 2	MPU Data Bus	Address Selection
	-22	DB1	Data Bus Bit 1	MPU Data Bus	Address Selection
	-23	DB5	Data Bus Bit 5	MPU Data Bus	Address Selection
	-24	DB3	Data Bus Bit 3	MPU Data Bus	Address Selection
	-25	TALKEN	Talk Enable	Status	Output
	-26	DB4	Data Bus Bit 4	MPU Data Bus	Address Selection
	-29/30	GND	Ground	Ground	—

TemPak® Accessories



Y2000 RTD MULTIPOINT SELECTOR

FEATURES

- The Y2000 is a RTD manual multipoint selector designed for use with the Fluke 2180A RTD Digital Thermometer.
- The Y2000 is a passive device which does not degrade or affect the accuracy or characteristics of the 2180A.

SPECIFICATIONS

The Y2000 does not degrade the accuracy or other characteristics of the 2180A. Each channel read will be identified by number when a digital printer is used with the 2180A (Option 21X0-002 installed).

Number of Channels	Ten, up to 100 with multiple Y2000's.
RTD Types Accomodated:	Six. See Specifications for 2180A.
RTD Types Selectable:	Two, five channels per type.
Power:	25 mW, supplied by 2180A
Accessory Bus:	Rear panel receptacle plus 46 cm cable with connector.

CONTROLS AND CONNECTORS

Refer to Figure 17-1 and Table 17-1 for a description of the Y2000's controls and connectors.

Figure 17-1. Y2000 Controls and Connectors

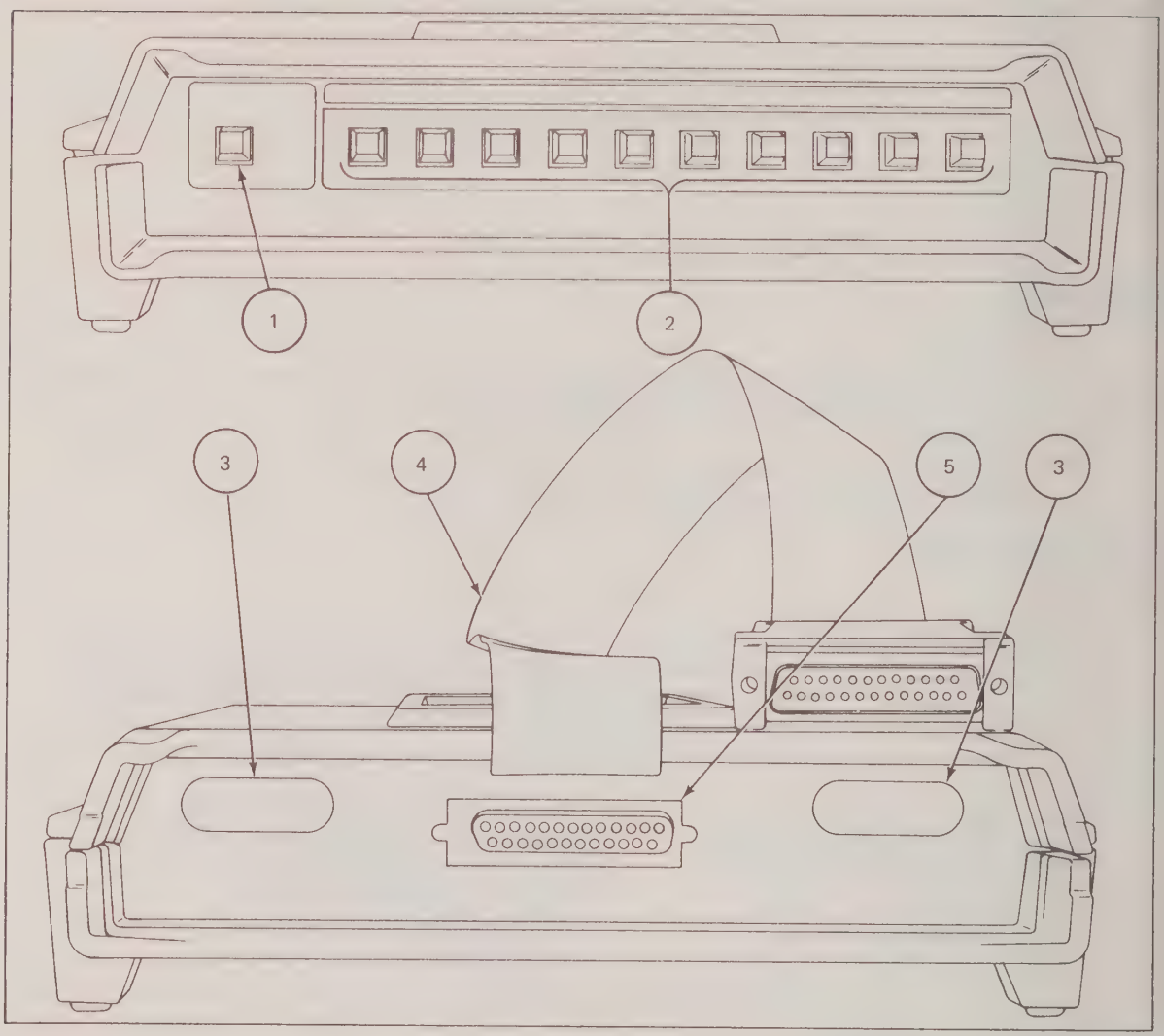


Table 17-1. Controls and Connectors

REF NO.	NAME	FUNCTION
1	EXTENSION	Out when channels 0-9 of the same Y2000 are in use. In when another Y2000 in series is in use.
2	CHANNEL Selectors	Push in to select RTD attached to that channel as input to 2180A Digital Thermometer. Only one switch can be used at a time.
3	Access Ports	Route connecting wires from RTD probes to terminal block connectors in the Y2000.
4	Accessory Bus Cable and Plug	Flexible cable attaches to ACCESSORY CONNECTOR on a preceding unit (2180A or another accessory).
5	Accessory Bus Connector	Accepts Accessory Bus Cable from a preceding accessory.

SWITCHES

Two dip switches on the main board of the Y2000 must be set before the RTD multipoint can be used with the 2180A. S1 and S2 are the RTD type select switches for Channels (5-9) and (0-4) respectively.

These dip switches should be set to correspond to the RTD probe type in use. The RTD types and the switch settings are as shown in Table 17-2.

Table 17-2. RTD Selection (S1, S2)

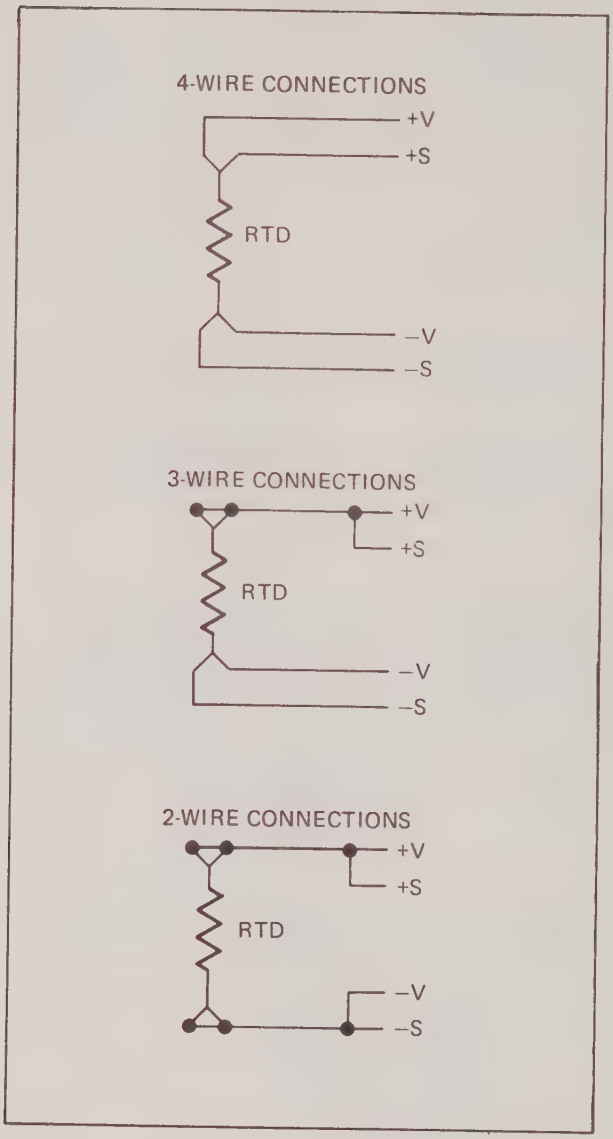
POS NO.	RTD TYPE	1	2	4	8
0	385 Pt. 100 Ohm	0	0	0	0
1	390 Pt. 100 Ohm	1	0	0	0
2	3902 Pt. 100 Ohm	0	1	0	0
3	392 Pt. 100 Ohm	1	1	0	0
4	100 Ohm Ni	0	0	1	0
5	10 ohm Cu	1	0	1	0
6	----				
7	----				

Notes:
For switch segments 1,2, 4 and 8: ON = 1, OFF = 0

RTD CONNECTIONS

Figure 17-2 shows the proper method of connecting RTD's to the Y2000.

Figure 17-2. RTD Connections



CHANNEL IDENTIFICATION WHEN 2180A-002 USED WITH Y2000

When the 2180A Digital Thermometer is equipped with the Output option (-002), it will be necessary to identify the selected channel to the remote printer (or other display device) in use. The least significant digit (0-9) of such an identification will be supplied by the CHANNEL switch selected on the Y2000. If more than one Y2000 (through a maximum of ten) is employed, it will also be necessary to provide a most significant digit (MSD) unique to each RTD Multipoint Selector. Provision for Y2000 MSD designation is made through the physical removal of diodes on the Y2000's Main PCB. These diodes, CR1-CR4 allow for BCD coding 0-9 as Y2000 identifiers. Remove appropriate diodes as follows:

CR1	for a count of:	8
CR2		4
CR3		2
CR4		1

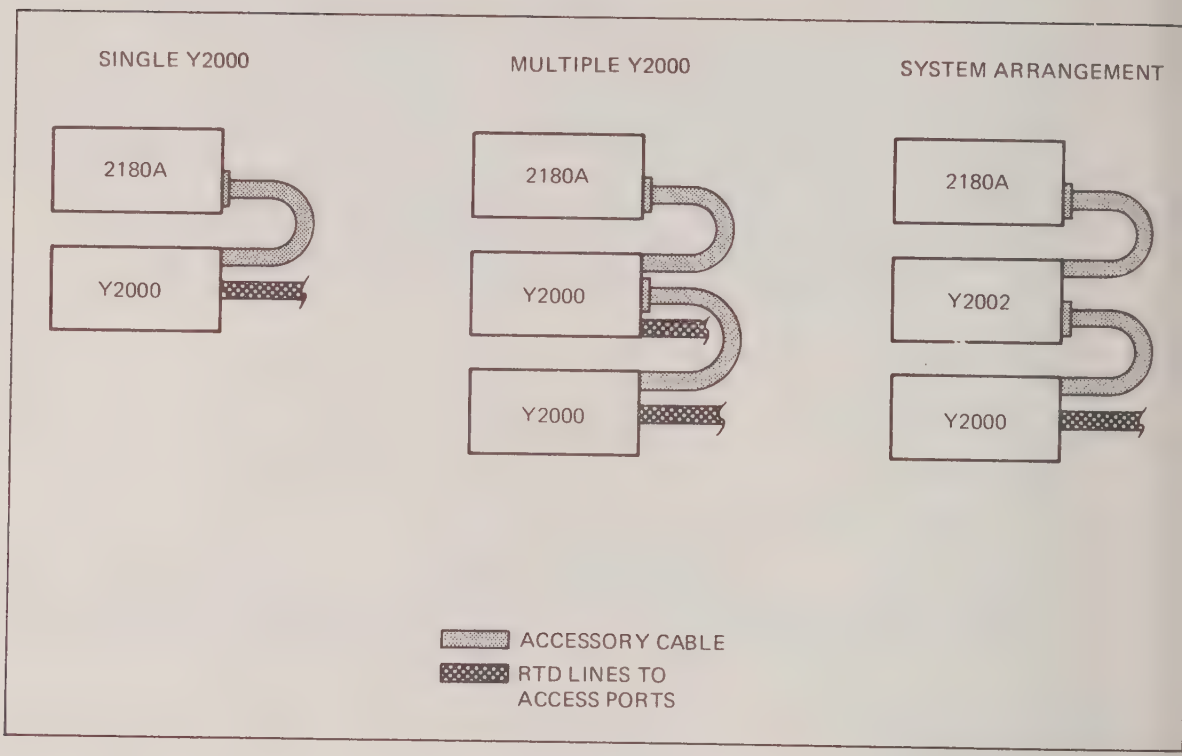
For example, if the fifth Y2000 in a chain is to be identified, clip out diodes CR2 and CR4 (4 + 1 = 5). Diodes CR1-CR4 will be found grouped in the right rear corner of the Main PCB.

SYSTEM CONNECTIONS

Refer to Figure 17-3 for typical system connections.

NOTE: When multiple Y2000's are in use, the EXTENSION pushbutton should be depressed on all units except the one to which the RTD of interest is connected.

Figure 17-3. Typical System Connections



Y2001 THERMOCOUPLE MULTIPOINT SELECTOR

FEATURES

The Model Y2001 Thermocouple Multipoint Selector is a manually switched scanner that allows selection of one of ten thermocouple inputs to be displayed by the 2190A Digital Thermometer. The Y2001 inputs are divided into two groups of five each so that two different types of thermocouple probes may be monitored. Two or more Model Y2001's can be stacked in a serial configuration when requirements for more than ten thermocouple probes exist.

SPECIFICATIONS

Specifications for the Y2001 Thermocouple Multipoint Selector are as follows:

The Y2001 does not deteriorate the accuracy or other characteristics of the 2190A. Each channel read will be identified by number when a digital printer is used with the 2190A with Option 21X0-002.

Number of Channels
Ten, up to 100 with more than one Y2001.

Thermocouple Types Accommodated
Seven, five per 2190A. See 2190A accuracy table.

Thermocouple Types Selectable
Two, five channels per type.

Maximum Voltage Between Channels
125V ac rms.

TemPak Bus
Rear panel receptacle plus 46 cm cable with connector.

CONTROLS AND INPUT/OUTPUT CONNECTIONS

Refer to Figure 17-4 and Table 17-3 for a description of the Y2001's controls and input/output connections.

Figure 17-4. Controls and Input/Output Connections

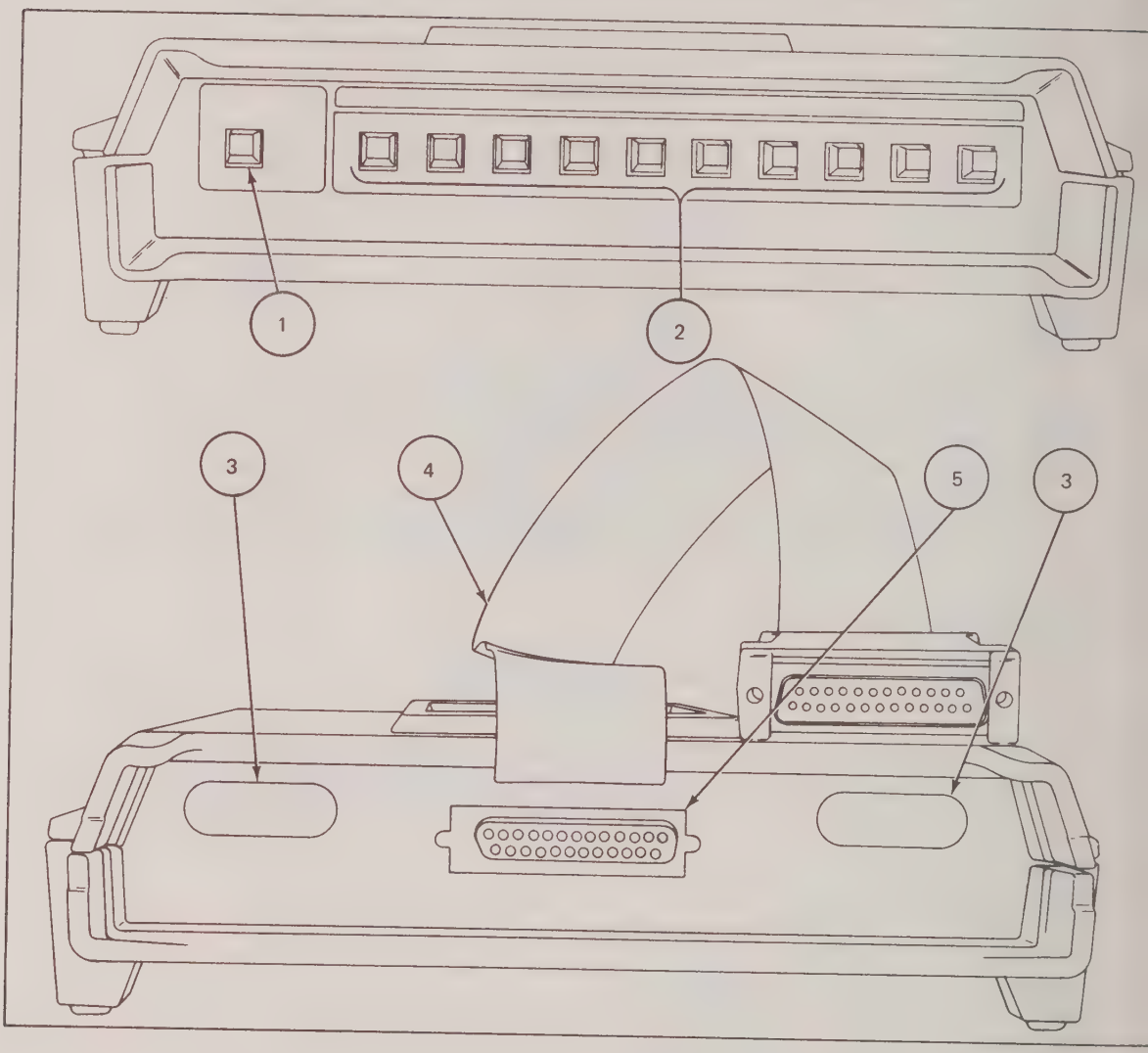


Table 17-3. Controls and Connectors

REF. NO.	NAME	FUNCTION
1	EXTENSION	Out when channels 0-9 of the same Y2001 are in use. In when another Y2001 in series is in use.
2	CHANNEL Selectors	Push in to select T/C attached to that channel as input to 2190A Digital Thermometer. Only one switch can be used at a time.
3	Access Ports	Route connecting wires from T/C probes to terminal block connectors in the Y2001.
4	Accessory Bus Cable and Plug	Flexible cable attaches to ACCESSORY CONNECTOR on a preceding unit (2190A or another accessory).
5	Accessory Bus Connector	Accepts Accessory Bus Cable from a preceding accessory.

WARNING: THE INTERIOR OF Y2001 SHOULD BE ACCESSED ONLY BY QUALIFIED PERSONNEL. LETHAL VOLTAGES MAY EXIST ON EXPOSED INPUT/OUTPUT TERMINALS DUE TO COMMON-MODE PROBE VOLTAGES.

Thermocouple inputs to the unit are on screw type terminals, two per input. They are accessible when the top cover is removed. Each pair (positive and negative) are marked with polarity and channel number (LSD if two or more units are used). The pairs are divided into two groups of five, each with a thermocouple type select switch. All inputs within a group must be of the same thermocouple type.

Two additional terminals are provided adjacent to the rear panel for the inputs from succeeding units. The accessory bus input from succeeding units is a 25-pin connector located at the center of the rear panel.

Outputs from the unit are on wires and a cable that are permanently attached to the unit PCB. Two wires are available for thermocouple inputs to the thermometer or any previous instrument in a series. The accessory bus is on a 25-wire flat cable with a standard 25-pin connector attached for connection to the thermometer or a previous instrument in the series.

SWITCHES

Two dip switches on the main board of the Y2001 must be set before the Thermocouple Multipoint can be used with the 2190A. S1 and S2 are the T/C type select switches for channels (5-9) and (0-4) respectively.

These dip switches should be set to correspond to the T/C sensor type in use. This setting will depend on the microprocessor type of the 2190A. See Table 7-3 in the section on 2190A in this guide for further information.

CHANNEL IDENTIFICATION

When the 2190A Digital Thermometer is equipped with Output Option (-002), it will be necessary to identify the selected channel to the remote printer (or other display device) in use. The least significant digit (0-9) of such an identification will be supplied by the CHANNEL switch selected on the Y2001. If more than one Y2001 (through a maximum of ten) is employed, it will also be necessary to provide a most significant digit (MSD) unique to each Thermocouple Multipoint Selector. Provision for Y2001 MSD designation is made through the physical removal of diodes on the Y2001's Main PCB. These diodes, CR1-CR4, allow for BCD coding 0-9 as Y2001 identifiers. Remove appropriate diodes as follows:

CR1	for a count of:	8
CR2		4
CR3		2
CR4		1

For example, if the fifth Y2001 in a chain is to be identified, clip out diodes CR2 and CR4 (4 + 1 = 5). Diodes CR1-CR4 will be found grouped in the right rear corner of the Main PCB.

SYSTEM CONNECTIONS

NOTE: When multiple Y2001's are in use, the EXTENSION pushbutton should be depressed on all units except the one to which the thermocouple of interest is connected.

Y2002 ALARMS OUTPUT

INTRODUCTION

The Y2002 Alarms Output provides for the setting of four separate limit values for comparison with the display reading on a 2180A or a 2190A Digital Thermometer. Separate alarm LED's, one associated with each limit setting, will be activated when the thermometer's displayed reading exceeds the set limit value. Each limit also controls a relay with rear panel connections; any one of the four limit positions can thereby be used to perform on/off control of external equipment. Either the 2180A or 2190A Digital Thermometer is capable of supporting one Y2002 Alarms Unit.

SPECIFICATIONS

The Y2002 Alarms output indicates up to four high and/or low out-of-limit temperature readings with one LED annunciator per limit. Also activates up to four relays, one relay per limit, for control of remote equipment.

Relays
Four Form C (SPDT), latching or non-latching, switch-selectable. Unlatched with front panel RESET pushbutton.

Relay Contact Ratings
230VA, 184V dc or 130V ac rms max, 2A max resistive.

Relay Connectors
Rear panel screw terminal block.

Limit Selections
Four sets of thumbwheels, one for each limit. High or low limit thumbwheel, + or - polarity thumbwheel, and four temperature thumbwheels, 1° resolution.

Accessory Bus
Rear panel receptacle plus 46 cm cable with connector. Y2002 must be located between 2180A or 2190A and any multipoint selector.

Power
250 mW, supplied by 2180A or 2190A via Accessory Bus.

CONTROLS, INDICATORS AND CONNECTORS

Refer to Figure 17-5 and Table 17-4 for a description of the controls, indicators and connectors of the Y2002.

Figure 17-5. Controls, Indicators, and Connectors

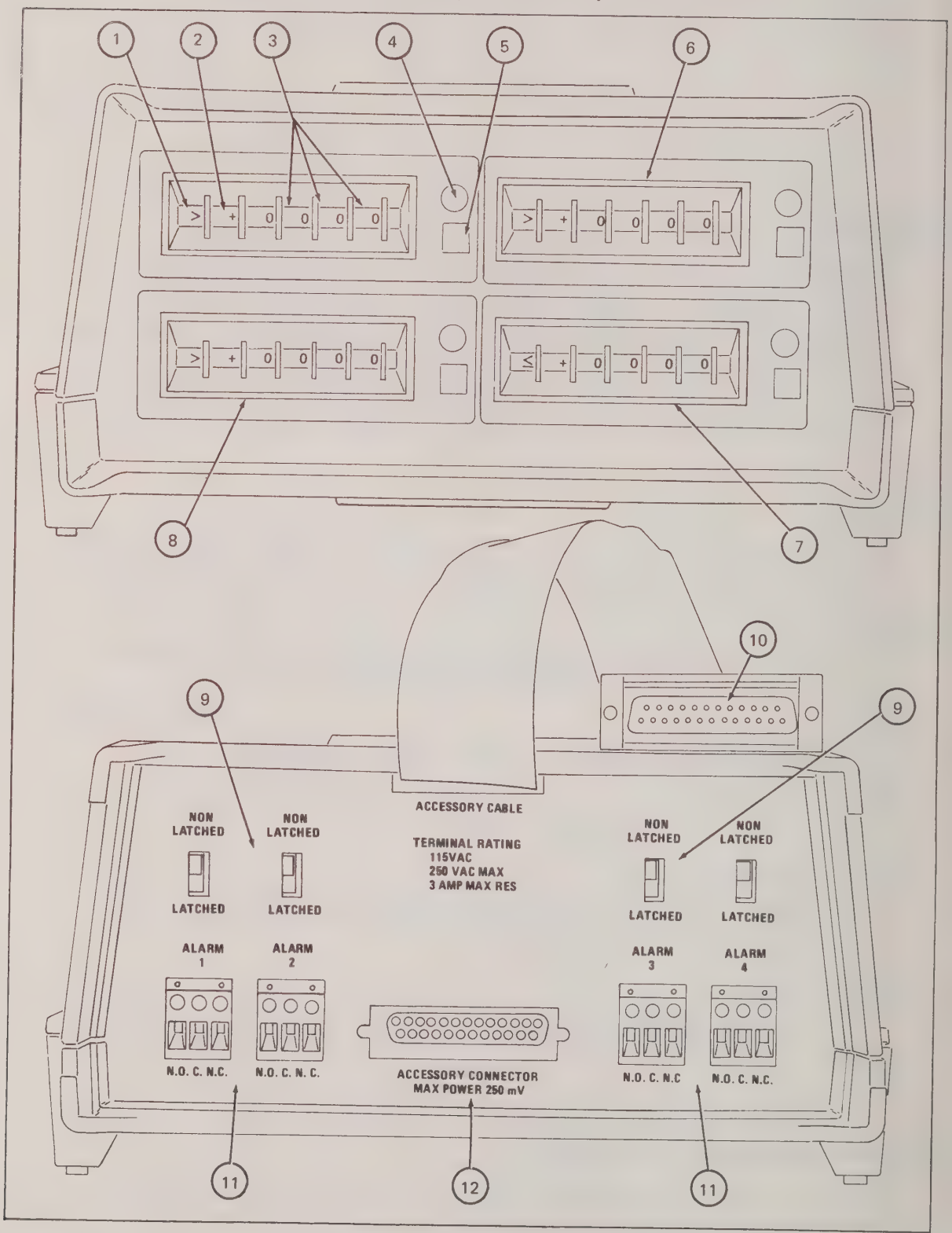


Table 17-4. Y2002 Controls and Connectors

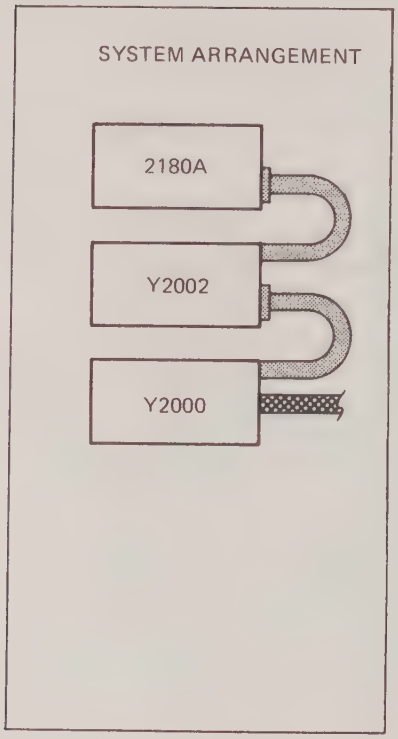
ITEM NO.	NAME	FUNCTION
1	Condition Switch	Allows for setting of alarm condition relative to a thermometer input. Alarm will be set if the thermometer reading is either > or ≤ the set limit.
2	Polarity Switch	Allows for setting of limit value polarity.
3	Limit Value Switches	Sets the limit value from 0000 through 9999. No decimal point.
4	Alarm LED	Comes on when set limit is exceeded.
5	Reset Switch	Used to clear previous alarm conditions.
6, 7,8	Other Alarm Point Controls, Indicators	Identical operation and indication as for Limit 1.
9	Latching Switches	In the non-latched position, a thermometer reading transitioning from alarm back within limits will cause alarm indications to extinguish. In latched position, alarm indications will not extinguish; RESET must be pressed instead.
10	Accessory Bus Cable	Connects the Y2002 to the Digital Thermometer's ACCESSORY CONNECTOR.
11	Alarm Relay Connections	Screw tightened terminals connect C to NO (Normally Open) and C to NC (Normally Closed) for control of external devices. Separate alarm relays 1-4 correspond to front panel limits 1-4.
12	Accessory Connector	Used to connect Y2002 to succeeding units on the Accessory Bus. (Accepts another unit's accessory bus cable.)

OPERATING NOTES

Refer to Figure 17-6 for a diagram of system hook-up.

NOTE: The Y2002 accessory bus cable may be plugged into only the 2180A or 2190A ACCESSORY CONNECTOR. Do not plug it into the Y2000 or Y2001 ACCESSORY CONNECTOR.

Figure 17-6. System Hook-up



ALARM RELAYS

Each limit setting will be associated with a limit relay. When a limit is not exceeded, relay common (C) is connected to the normally closed (NC) contact. When a limit is exceeded, relay common will be connected to the normally open (NO) contact. Separate terminal blocks for each set of relay connections (C, NC, NO) are located on the rear panel. When making connections, insert the appropriate wire into the C, NO, or NC terminal slot and tighten the associated screw. Refer to the Specifications for relay maximum ratings.

Latching/Non-Latching Operation

Each channel on the Y2002 will also have a latched-non-latched slide selector switch. In the non-latched position, a reading transition on the 2180A or 2190A Digital Thermometer from in excess of limit back to within limit will cause limit indications to clear. The limit LED will go out, and the limit relay will connect C to NC. In the latched position, such a transition will not cause the limit indications to clear; press RESET instead.

Setting Limits

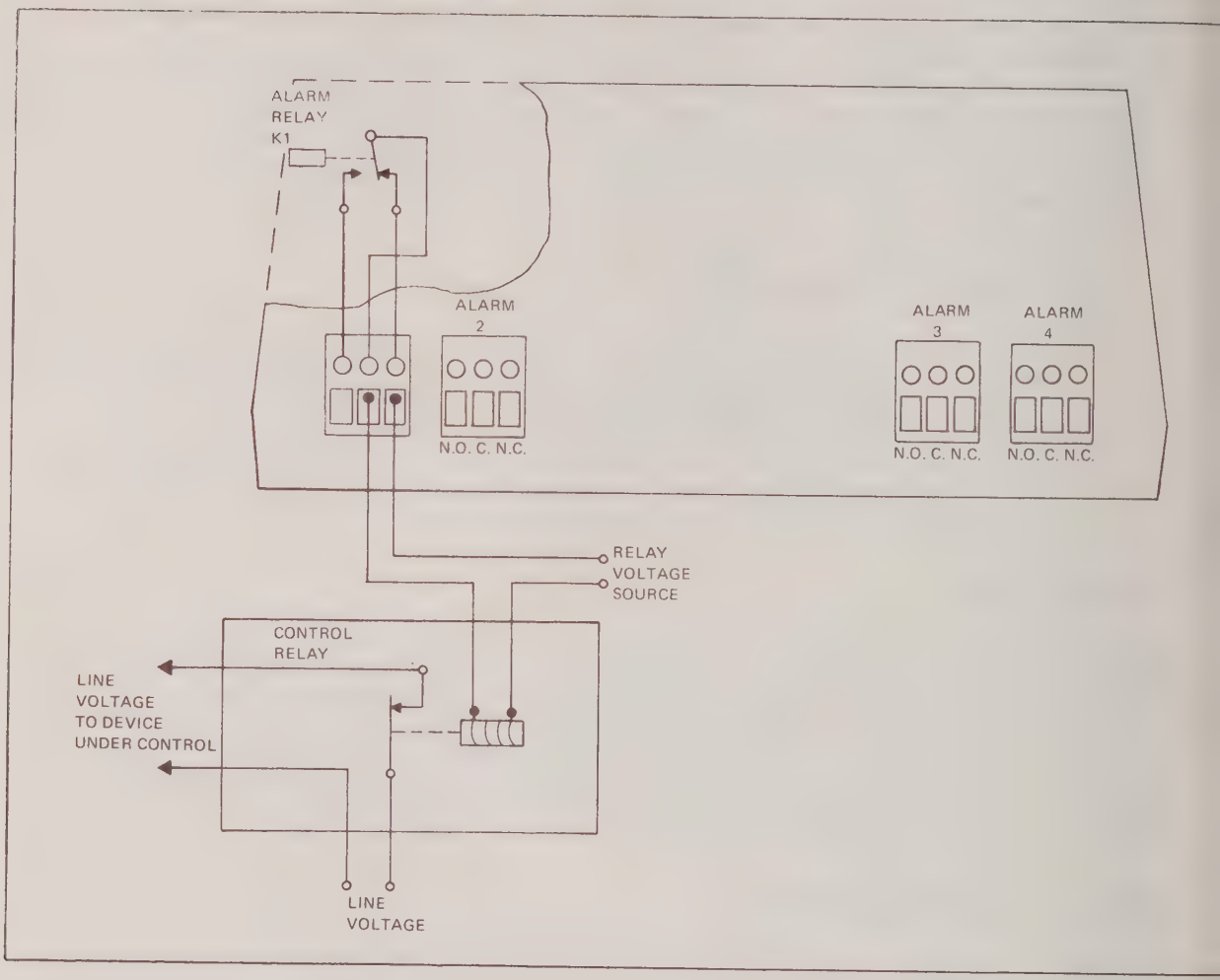
Limit selection on the Y2002 consists of relative condition and four digit value settings. The relative condition will determine the relationship that the digital thermometer's reading must have to the limit value for an alarm to be set. If a reading greater than the limit setting is to cause an alarm condition, set >. If a reading less than or equal to the limit is to cause an alarm condition, set $\leq$. The four digit value may be set to any desired number. The least significant digit will always correspond to the 1^{o} (^{o}C or ^{o}F) digit on the associated thermometer.

Controlling External Devices

Any one of the four limit positions may be used to control external devices. The alarm relays may be utilized as in the following example. Refer to Figure 17-8 when connecting the Y2002 as a controller.

1. Set the relay to non-latching mode (rear panel switches for each limit).
2. Connect the equipment to be controlled (typically a power contactor or relay) to the relay output terminals C and NC (normally closed).
3. Set the limit thumbwheel to the desired temperature and relative condition (> or $\leq$).
4. Whenever the measured temperature is exceeded, the Y2002 relay will activate, connecting output terminals C to NO (normally open), and removing power from the equipment under control.
5. When the measured temperature returns below the limit setting, the alarm relay will return to the NC state and cause power to be reapplied to the equipment.

Figure 17-8. External Control Connections



Y2003 CALIBRATOR

INTRODUCTION

The Model Y2003 is a thermocouple simulator and a battery pack. It is designed to be used with the Model 2190A as a portable thermocouple thermometer calibrator (see Figure 1). It can simulate all of the seven thermocouples available on the 2190A over their full temperature range. The Y2003's calibration voltage may be varied from -10 to +90 mV dc using the front panel coarse and fine potentiometers. The third front panel potentiometer, OFFSET ADJUST, will add (when enabled) an additional 0 to 10° change in the calibration voltage, which is ideal for checking the linearity and response of an external strip chart recorder or analog meter.

The Y2003 has been designed to allow the 2190A to become a portable temperature reference for thermocouple thermometers. Its +12V dc output, 750 mA output can be used with any instrument with an external 12 volt input.

SPECIFICATIONS

Electrical

Compatible Thermocouples
J, K, E, R, S, T, B, and *C (* not an ANSI symbol).

Operating Range
°C °F: Same as 2190A (see specifications in 2190A manual).

Operating Power
+12V dc (supplied by internal rechargeable battery pack).

Input Connections
Screw terminals on +12V dc connector.

Offset Correction
Uncalibrated DC output, manually variable (simulates a 0 to 10°C change in temperature). (Dependent on thermocouple selected.)

Output Impedence
100 ohm

Range
-10 to +90 mV dc, 25°C.

Specifications, Cont.

Stability
20 ppm/°C, from 25°C.

General

Rechargeable Battery Pack Output
+12V dc, 750 mA max.

Rated Capacity
2.2 Amp hours.

Battery Type
10, Ni-cad 1/2 D size cells (fully encapsulated in a drip-proof case).

Operating Time
5 to 6 hours typical at 25°C on full charge when used in conjunction with the 2190A.

Recharge Time
16 hours typical at 25°C.

Battery Charge
Internal, with automatic low battery cut off circuit.

Output Connectors
Rear panel screw terminal block.

Power Requirements
Switch selectable for 100, 120, 200 or 240 volts ac ± 10%, 50 to 400 Hz.

CONTROLS, INDICATORS AND CONNECTORS

Refer to Figure 17-9 and Table 17-5 for a description of the Y2003's controls, indicators, and connectors.

Figure 17-9. Controls, Indicators, and Connectors

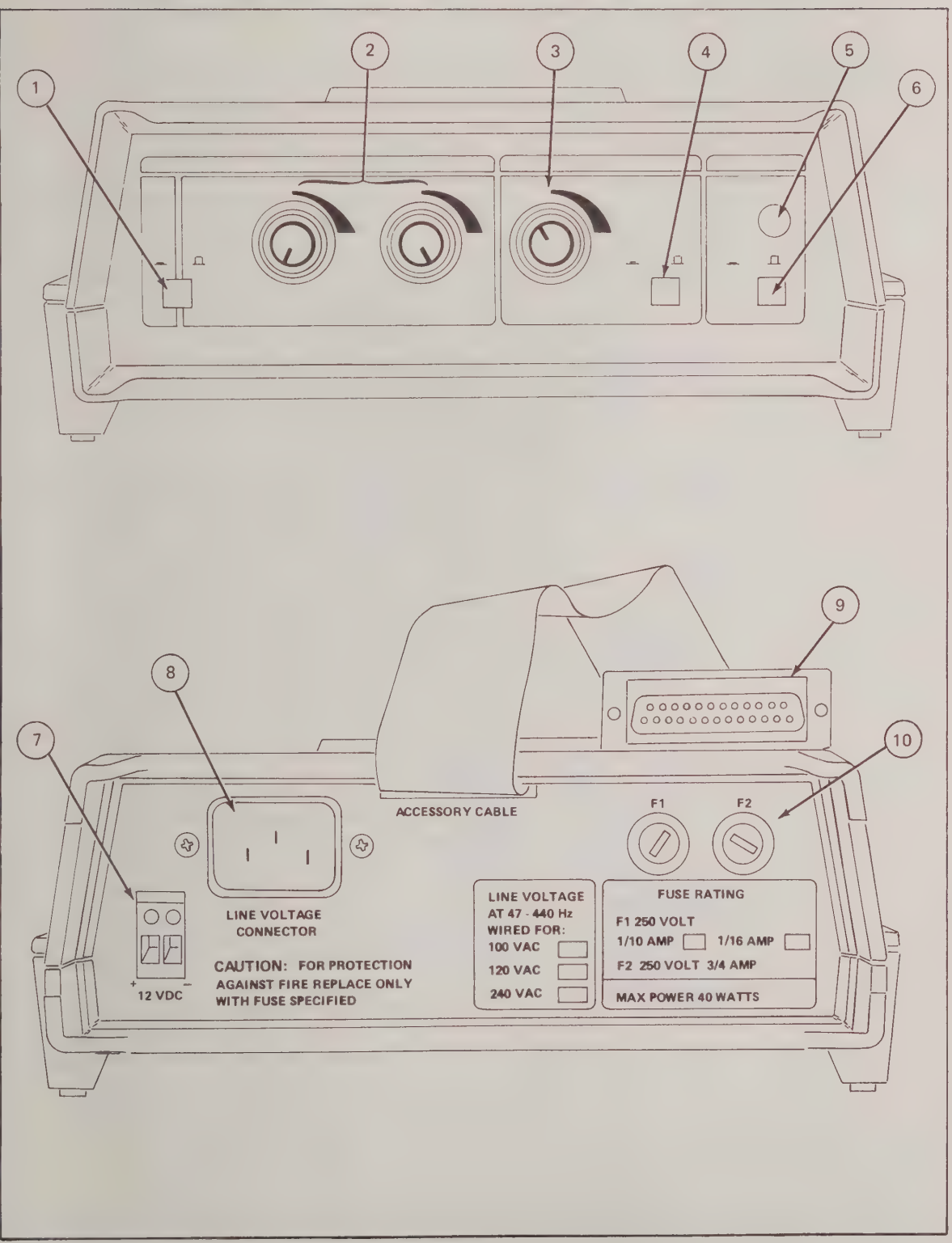


Table 17-5. Controls, Indicators, and Connectors

ITEM NO	NAME	FUNCTION
1	METER/CAL	A push-push button used to enable/disable the calibration voltage without affecting the +12V dc output, in = disable, out = enable.
2	COARSE, FINE	Two ten-turn potentiometers which together will vary the calibration voltage from -10 to +90 mV dc.
3	OFFSET ADJUST	A ten-turn potentiometer which when enabled will add an additional 0 to 50°C voltage change to the calibration voltage.
4	ENABLE/DISABLE	A push-push button which add or remove the OFFSET voltage from the calibration voltage, in = enable, out = disable.
5	LO BTRY	An LED which lights to indicate that the battery pack requires charging.
6	ON/OFF	A push-push button which enables/disables the battery charger. Out = charger enabled, +12V dc output disabled. In = charger disabled, +12V dc output enabled.
7	12 VDC	A two terminal block which allows an external load to be connected to the Y2003 battery pack.
8	LINE VOLTAGE CONNECTOR	A three-prong receptacle which allows the Y2003 to be connected to a compatible line source.
9	ACCESSORY CABLE	A 32-pin output connector which carries the calibration voltage to the 2190A and the +15V operating voltage to the Y2003.
10	F1, F2	In line fuses, F1 is the ac line fuse, F2 is the battery pack fuse.

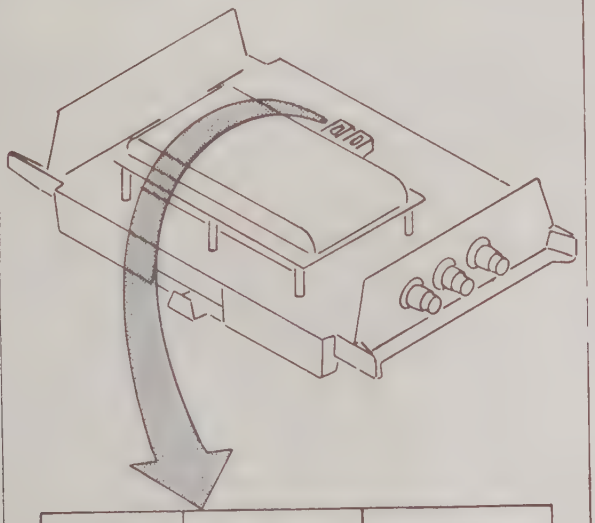
LINE VOLTAGE SELECTION

Refer to Figure 17-10. Voltage Source Selection for selecting the proper line voltage switch setting.

Figure 17-10. Voltage Source Selection

NOTE

To select line voltage, place slot on each switch toward corresponding number on pcb; 100, 120, 220 or 240.



VOLTAGE	S2	S5
100V	SLOT 240 220 100 120	SLOT 100 220 120 240
120V	SLOT 240 220 100 120	SLOT 100 220 120 240
240V	SLOT 240 220 100 120	SLOT 100 220 120 240
220V	SLOT 240 220 100 120	SLOT 100 220 120 240

POWER REQUIREMENTS

A. CALIBRATOR:

The Y2003 Thermocouple Calibrator is designed to be used together with the 2190A Digital T/C thermometer. The actual calibrator circuitry on the Y2003 operates from power supplied to it from the 2190A. Together, this calibration system may be powered from 3 different sources.

1. Line power: This is accomplished by simply attaching the line cord to the 2190A's line receptacle located at the rear of the thermometer. Connecting the Y2003's accessory cable to the accessory connector at the rear of the 2190A provides the Y2003 with power to perform calibrations.

2. External 12V: Attach the + and - leads from an external 12 volt power source to the 2190A 12 volt power receptacle at the back of the 2190A. Then connect the Y2003's accessory cable to the thermometer's accessory connector.

3. Internal 12V dc: The Y2003's battery pack circuitry is capable of providing the necessary operating power to the 2190A for up to 6 hours of use if properly charged. Simply attach #18 two connector wire from the screw terminals marked +12V dc on the back of the 2190A to the screw terminals on the rear of the Y2003. Then set the BTRY CHARGE switch to the IN position. See the section following regarding proper use of battery charger to charge the Y2003's battery pack circuitry.

B. Battery Pack Operation

The Y2003 can be used as a battery pack for the 2190A or any other instrument which requires +12V dc, at 750 mA max. The rated capacity is 2.2 amp-hours, or about 5-6 hours typical at 25°C on full charge when used with the 2190A. To use, simply connect the Y2003's 12V dc output to the 12V input of the test instrument. Press the BTRY PWR/CHARGE button to the IN position.

The battery pack's charger circuitry is charged from line power. To charge, attach the power cord provided to the line power receptacle at the back of the Y2003 and depress the battery power/charge switch to the OUT position. While being charged, the 12 volt dc output from the Y2003 is disabled.

The LO BTRY LED will light when the Y2003 must be recharged, and the 12V dc output will be disabled. NOTE: If the batteries have been discharged to a sufficiently low point, the LED will go out, but the battery will still need charging.

NOTE: For storage purposes the BTRY PWR/CHARGE STORAGE switch must be pressed to its ON position (IN). This will prevent the low battery indicator from discharging the internal battery.

USING THE CALIBRATOR

NOTE: See AB-47 Application Bulletin for further information.

A. Calibrating digital thermocouple thermometers.
Refer to Figure 17-11.

1. Attach the ribbon cable from the Y2003 to the 2190A.

2. Set the 2190A's thermocouple type select switch to match the thermocouple type of the digital thermometer to be calibrated (the Unit Under Test, or UUT). See the section on the 2190A in this guide or the manual in order to set the dipswitches located on the 2190A's thermocouple input module.

3. Using the proper type thermocouple wire, connect one end to the reference junction of the 2190A and the other end to the reference junction of the UUT.

4. Power up the units. If the Y2003 is to furnish power to the 2190A, ensure that the BTRY PWR/CHARGE switch is IN and that the LO BTRY LED is OFF.

5. The offset button should be DISABLED.

6. Set the METER/CAL switch to CAL.

7. Adjust the coarse and fine knobs to the Y2003 until the display on the 2190A reads the desired calibration temperature.

8. Next check the reading on the UUT and adjust the UUT until its reading matches that of the 2190A.

9. Repeat steps 6 and 7 at zero and full scale, or any other calibration points desired.

10. A step offset can be switched in at any time to test the UUT's linearity or scale factor, as well as checking instrument time response. This is easily done by setting the offset pushbutton to ENABLE.

B. Calibrating Analog Thermocouple Thermometers (Pyrometers)

Refer to Figure 17-12, Calibrating Analog Thermocouple Thermometers

1. Follow the instructions exactly given for calibrating a digital thermocouple thermometer.

2. In addition, it is necessary to match the impedance of the pyrometer's movement coil. Most meters will have an external resistance specification engraved on their faceplates. You must either use a sufficient length of thermocouple wire to match this impedance, and/or add a resistor to the circuit as shown in Figure 17-12.

Figure 17-11. Calibrating Digital Thermometers

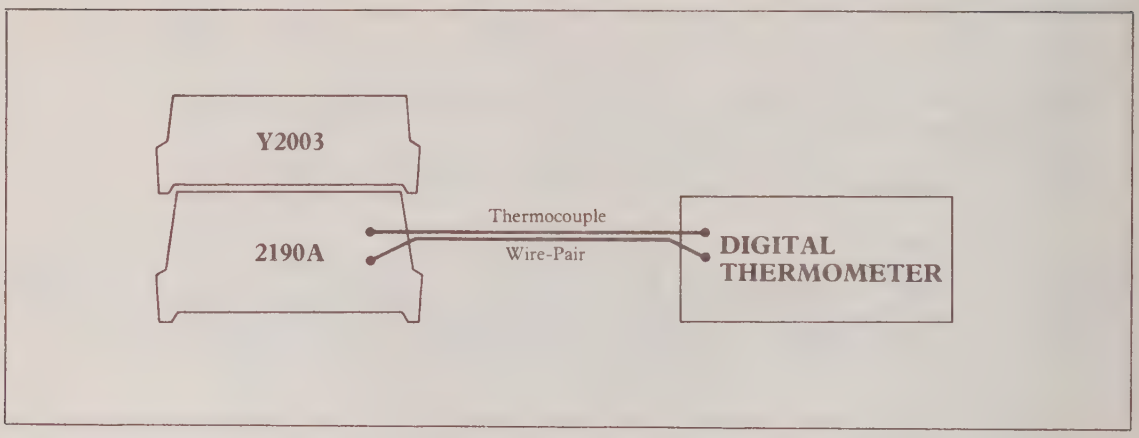
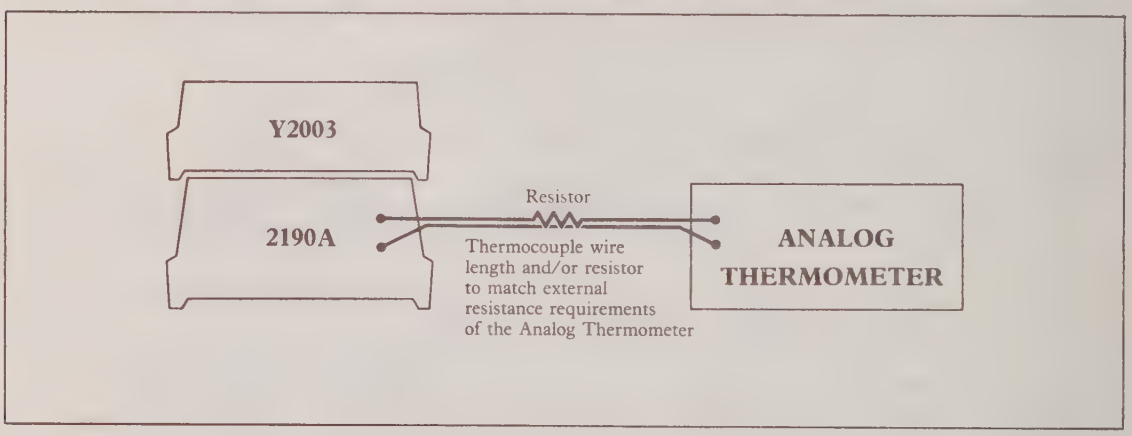


Figure 17-12. Calibrating Analog Thermocouple Thermometers



NOTE: If the instrument being calibrated has a low input impedance, then the Y2003 may be limited to a temperature range which is less than the full range of the instrument.

C. Calibrating Analog Thermocouple Chart Recorders

Refer to Figure 17-13, Calibrating Analog Thermocouple Chart Recorders.

1. Follow exactly the instructions given for calibrating digital thermocouple thermometers.

D. Calibrating Millivolt Chart Recorders and Indicators

Refer to Figure 17-14, Calibrating Millivolt Chart Recorders and Indicators.

1. On the thermocouple input module of the 2190A, set the dip switches to 8 or 9. This causes the 2190A to bypass its linearization programs and read and display microvolts.

2. Attach the Y2003 to the 2190A via the grey accessory cable.

3. Set the offset switch to DISABLE.

4. Set the METER/CAL pushbutton to CAL.

5. Next adjust the output of the Y2003 using the Coarse and Fine Adjust knobs. To interpret the display on the 2190A, ignore the $^{o}C/^{o}F$ indication and IGNORE THE DECIMAL POINT. The display will show microvolts. Thus, a display reading of $2105.0^{o}C$ corresponds to 21,050 uV, or 21.05 mV.

6. Again, the Offset switch may be enabled to check the linearity and time response of the chart recorder or millivolt indicator.

Figure 17-13. Calibrating Analog Thermocouple Chart Recorders

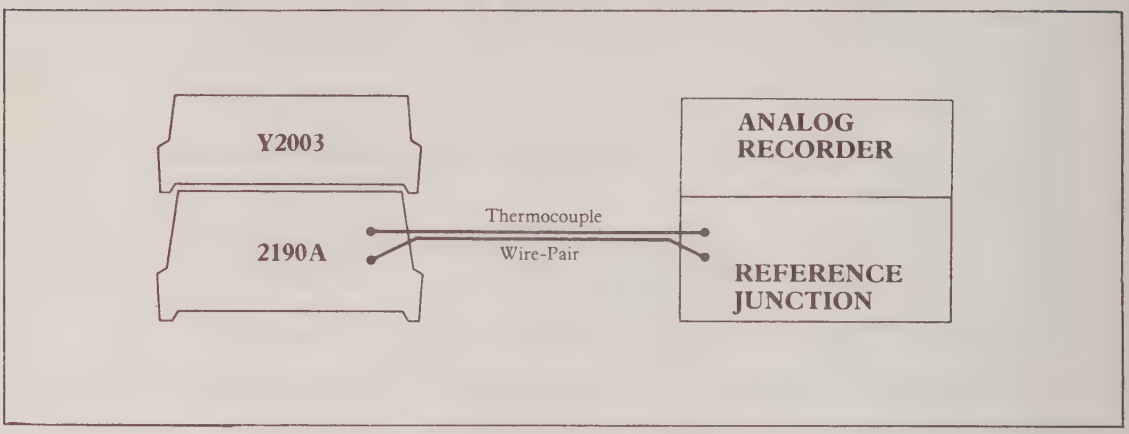
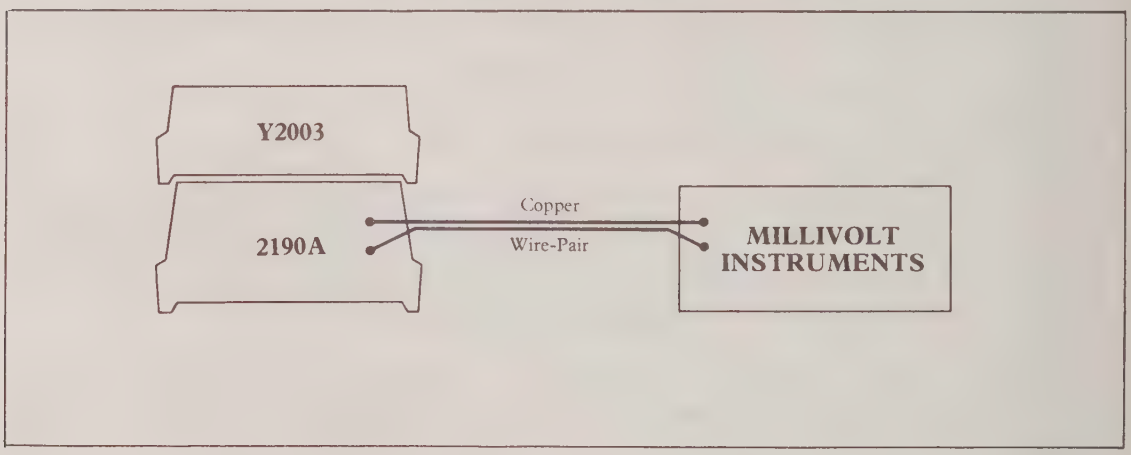


Figure 17-14. Calibrating Millivolt Chart Recorders and Indicators



Y2009

INTRODUCTION

The Model Y2009 is a rechargeable batter pack and charging unit that maintains a constant 12V dc output. The Y2009 was designed to be used primarily with the Models 2190A or 2180A Digital Thermomters; it will, however, be completely compatible with any instrument that operates on 12V dc, 750 mA max. When the battery pack is fully charged it will allow the 2190A, 2180A to operate as portable instruments for up to six hours. Use of nickel cadmium batteries assure a constant output over the batteries' entire capacity. The Y2009 also provide a unique load removal/low battery indicator circuit which protects the battery pack from deep discharge as well as giving a visual indication of low battery charge.

SPECIFICATIONS

Electrical

Output
12V dc, 750 mA max.

Rated Capacity
2.2 Amp-hr.

Recharge Time
16 hours typical at 25°C.

General

Battery Type
10, Ni-cad 1/2 D size cell (fully encapsulated in a drip-proof case).

Battery Charger
Internal, with automatic low battery cut-off circuit.

Output Connection
Rear panel screw terminal block.

Power Requirements
Switch selectable for 100, 120, 200 or 240 volts ac ±10%, 50 to 400 Hz.

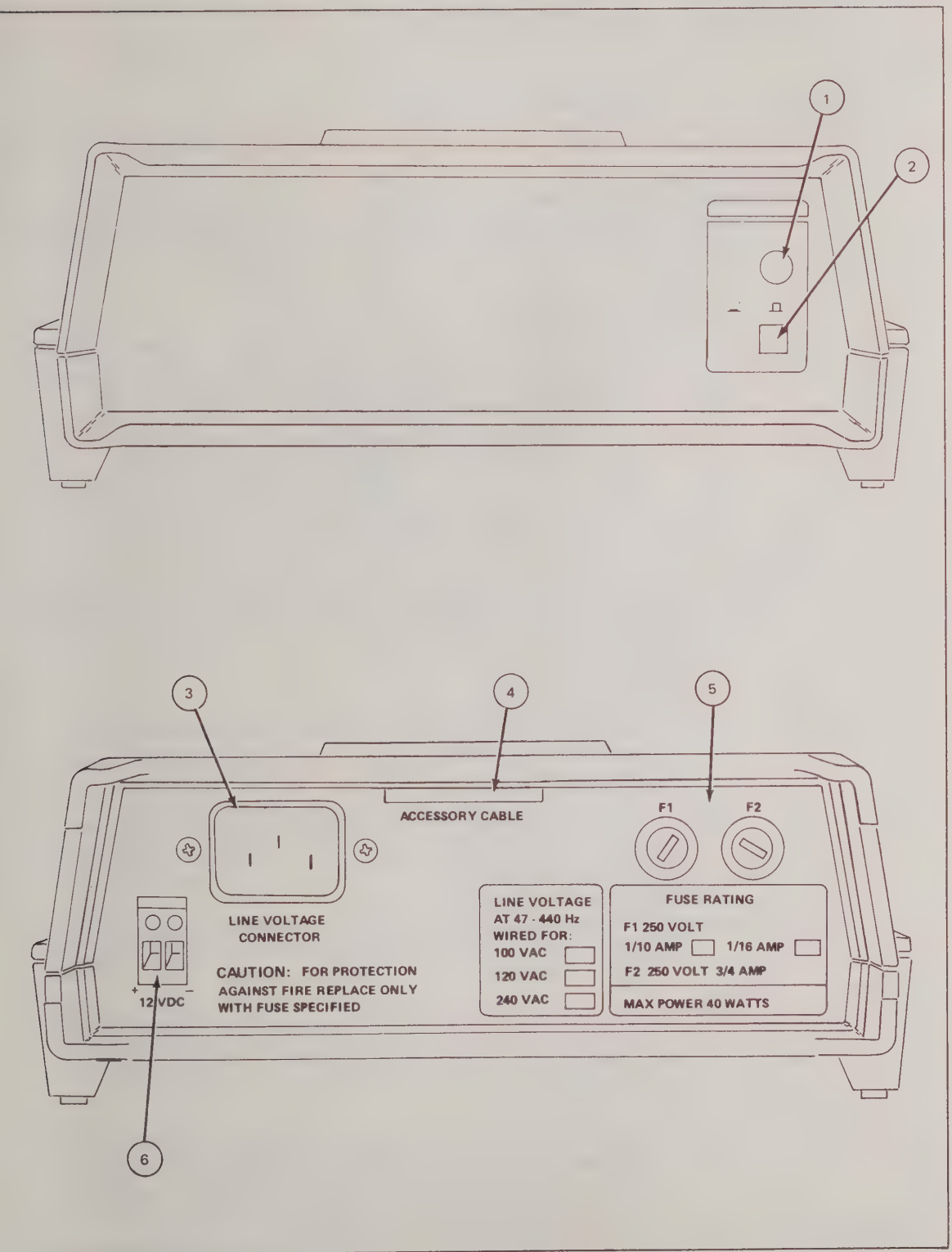
CONTROLS, INDICATORS AND CONNECTORS

Refer to Figure 17-15 and Table 17-6 for a description of the Y2009's controls, indicators and connectors.

Table 17-6. Controls, Indicators and Connectors

ITEM	NAME	FUNCTION
1	LO BTRY	An LED which lights to indicate that the battery pack requires charging.
2	ON/OFF	A push-push button which connects/disconnects the battery charger to the line source. Out = charger enabled, 12V dc output disabled. In = charger disabled, 12V dc output enabled.
3	LINE VOLTAGE	A three-prong receptacle which allows the Y2009 to be connected to a compatible line source.
4	ACCESSORY CABLE	Not used.
5	F1, F2	In line fuses, F1 is the ac line fuse, F2 is the battery pack fuse.

Figure 17-15. Controls, Indicators, and Connectors



LINE VOLTAGE SOURCE SELECTION

Refer to Figure 17-16, Voltage Source Selection.

OPERATION

The Y2009 Battery Pack has 2 operating modes: Battery Charge and Operate.

A. Battery Charge

Although the operate mode provides for trickle charging the battery pack, depressing the BTRY PWR/CHARGE STORAGE switch to the OUT position will fast charge the batteries.

1. Points to consider

a. Full charge requires approximately 16 hours at 25°C.

b. To charge the Y2009, connect the Y2009 to line voltage. Ensure that the source selection switch is set to the proper line voltage in use.

c. While in the battery charge mode, the Y2009's 12V dc output is disabled.

B. Operate

This mode is used when an instrument is connected to the 12V dc output of the Y2009. No line cord need be connected to either the instrument in use or the Y2009.

1. Points to consider

a. The Y2009 can be used with any instrument which requires +12V dc at 750 mA max. Rated capacity is 2.2 Amp-hrs.

b. The LO BTRY LED will light when the batteries are low. At this point the 12V dc output of the Y2009 will be disabled.

c. To use the Y2009 in the operate mode, ensure that the front panel BRY PWR/CHARGE STORAGE switch is in the IN position.

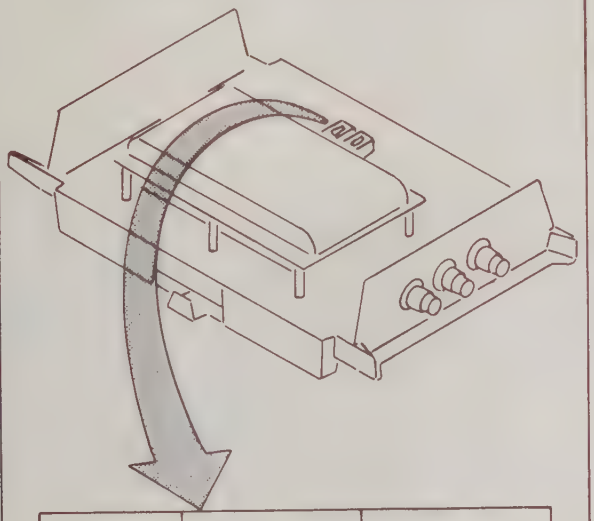
d. It is possible for the LO BTRY LED to not be lit but the Y2009 to need re-charging. This can happen if the batteries are discharged below the forward voltage drop of the LO BTRY LED.

NOTE: For storage purposes the BTRY PWR/CHARGE STORAGE switch must be pressed to its ON position (IN). This will prevent the low battery indicator from discharging the internal battery.

Figure 17-16. Voltage Source Selection

NOTE

To select line voltage place slot on each switch toward corresponding number on pcb; 100, 120, 220 or 240.



VOLTAGE	S2	S5
100V	SLOT 240 220 100 120	SLOT 100 220 120 240
120V	SLOT 240 220 100 120	SLOT 100 220 120 240
240V	SLOT 240 220 100 120	SLOT 100 220 120 240
220V	SLOT 240 220 100 120	SLOT 100 220 120 240

Y2026B RS-232-C CABLE ADAPTER

FEATURES

The Y2026B allows models 2180A, 2190A, or 2300A to connect to an RS-232 device. This is necessary because the 36-pin PTI connector located on the rear of the test instrument is not a standard RS-232 connector, although there are standard RS-232 signals available on the PTI connectors. The Y2026B is a convenient means of connecting RS-232 equipment to PTI equipment and eliminates the need of having the customer custom wire his or her own cable.

In addition, the Y2026B can allow the data from a 2180A, 2190A, or 2300A to be sent simultaneously to a PTI printer and an RS-232 device. (The 2020A requires a -004 PTI Interface Option).

CONNECTOR AND SWITCH LOCATIONS

Refer to Figure 17-17 for a diagram of connector and switch locations.

OPERATION

The following procedure assumes that the Y2026B is to be installed in a system using a thermometer, a printer, and an RS-232 device. For installation in a system that doesn't require all components, perform only those steps related to the components required.

1. Connect J3 on the Y2026B to a digital thermometer (2180A/2190A) or scanner (2300A) using PTI cable number Y7203, supplied with the Y2026B Cable Adapter. NOTE: If a 2180A or 2190A is being used without a 2300A scanner, a -002 Output Option must be installed in the thermometer.

2. Connect J4 on the Y2026B to a PTI printer (2020A, 2021A, or 2030A) using a second PTI cable (Y7203 or Y7204).

3. Connect J1 or J2, or both, to an RS-232 data terminal or data set using a standard RS-232 connecting cable.

4. Set the six slide switches on the Y2026B to establish the pin configuration required for the RS-232 device in use.

5. Typical settings for the slide switches are shown in Table 17-7.

Figure 17-17. Connector and Switch Locations

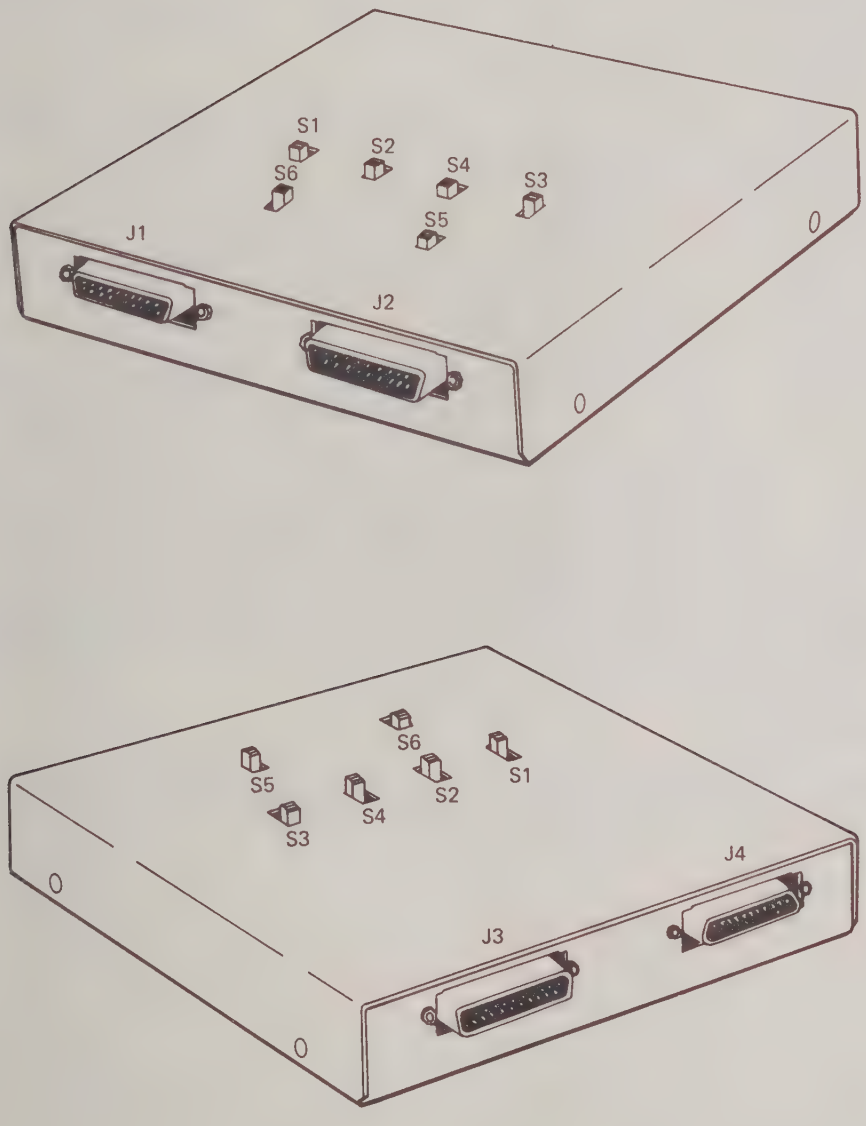


Table 17-7. Typical Control Line Switch Settings

COMMUNICATION TYPE	SWITCH SETTINGS			
	DTR(S1)	DSR(S2)	CTS(S3)	SCANNER BUSY
RS-232 Terminal to & from 2180A/2190A-002	To DSR	Through	Pulled-up	N/A
RS-232 Modem to & from 2180A/2190A-002	To DSR	Through	Through	N/A
RS-232 Terminal to & from 2300A Scanner	To DSR	Pulled-up	Pulled-up	To CTS
RS-232 Modem to & from 2300A Scanner	Through	Through	Through	Through

6. NOTE: A continuous data output from the thermometer or scanner, without regard for the control input at J1 and J2, can be established by setting both the CLEAR TO SEND and the DATA SET READY switches to the PULLED-UP position. Both control lines, with the switches set to PULLED-UP, are held at a high logic level through resistors in the thermometer or scanner.

SWITCHING - PIN OUTS

Refer to Figure 17-18, Simplified Control Signal Switching, and Figure 17-19, TX/RX Data Switching for pin-outs of control lines.

Figure 17-18. Simplified Control Signal Switching

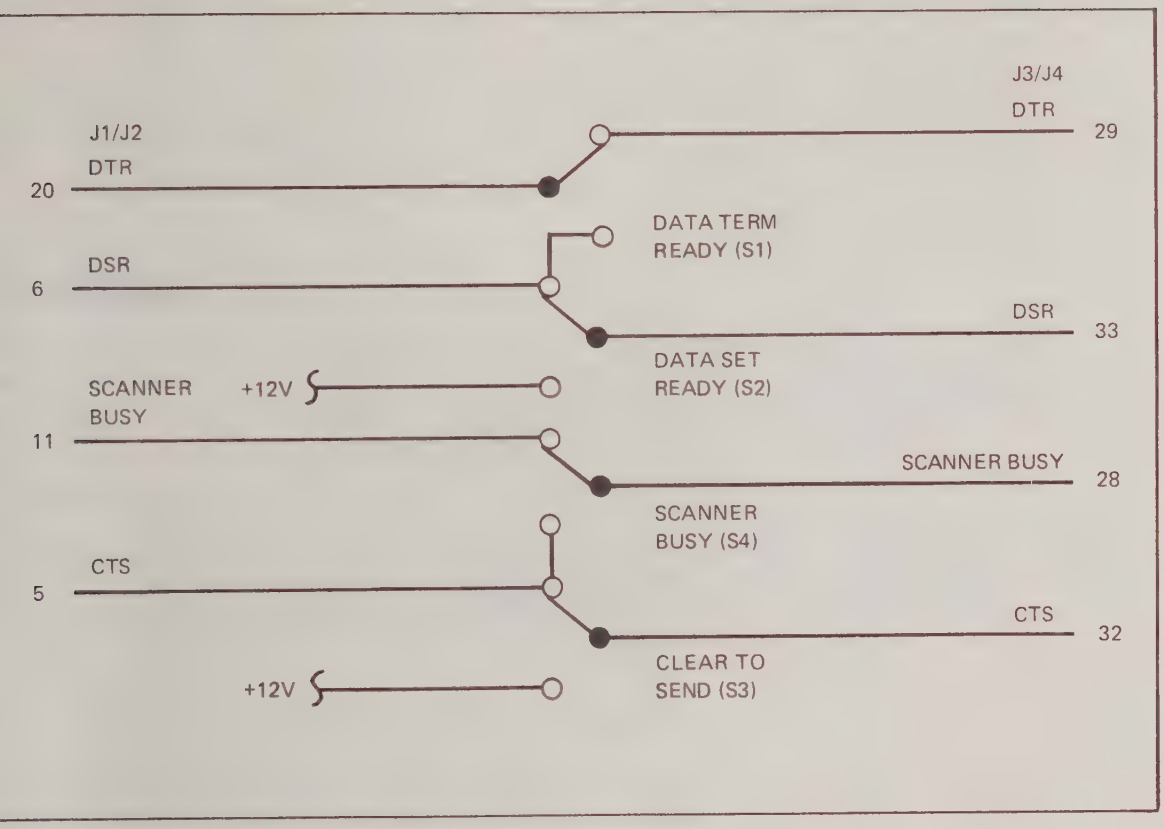
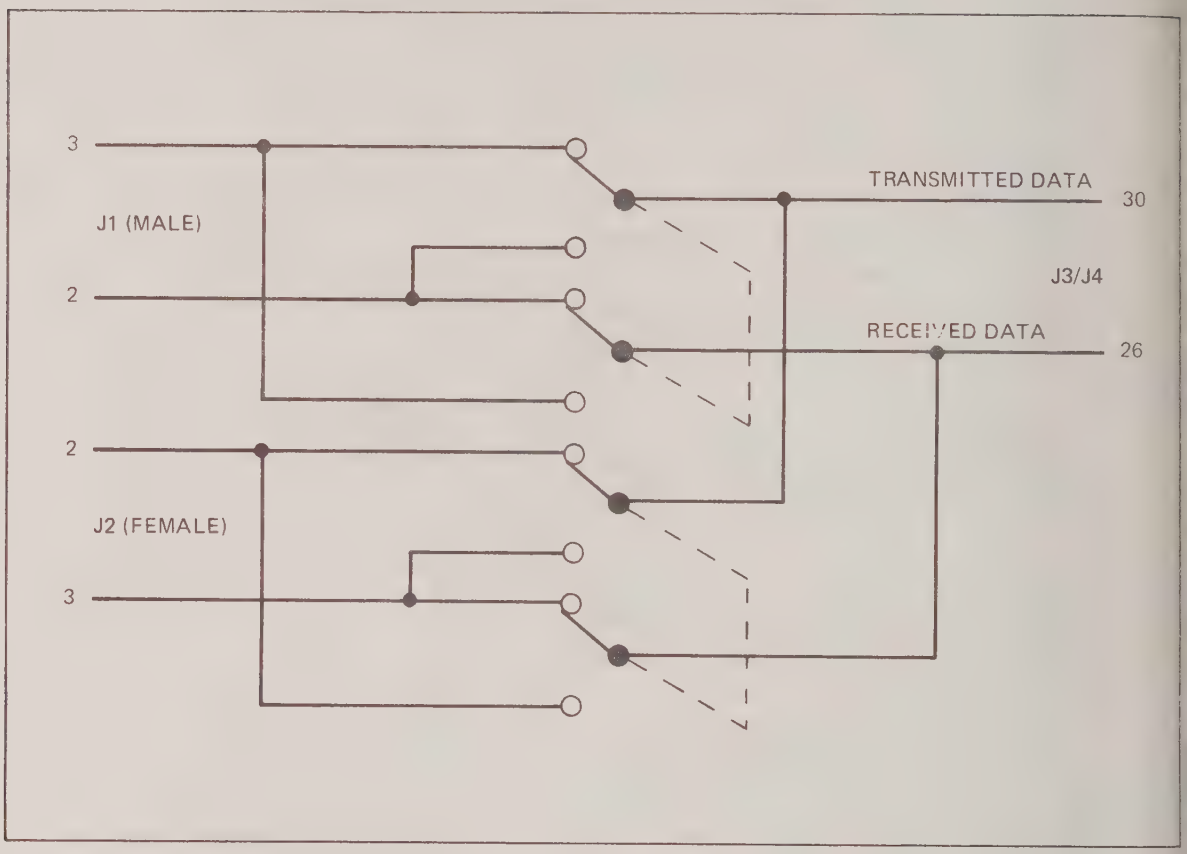


Figure 17-19. TX/RX Data Switching



Y2034 INTERCONNECT ACCESSORY

INTRODUCTION

The Model Y2034 Interconnect Accessory is a passive coupling device that allows an output device such as a printer or a Model 1120A Translator to select one of five possible test instruments as an input. The Model Y2034 includes a drawer for storage of probes, cables, and small parts.

SPECIFICATIONS

Pins 1 through 18 on each connector are wired in common to the corresponding pins of the other connectors. Pins 19 through 36 are not connected. The Y2034 is plug compatible with any PTI (Portable Test Instrument) 36-pin interface instrument.

Input
: Five 36-pin AMP CHAMP male connectors.

Output
: One 36-pin AMP CHAMP female connector.

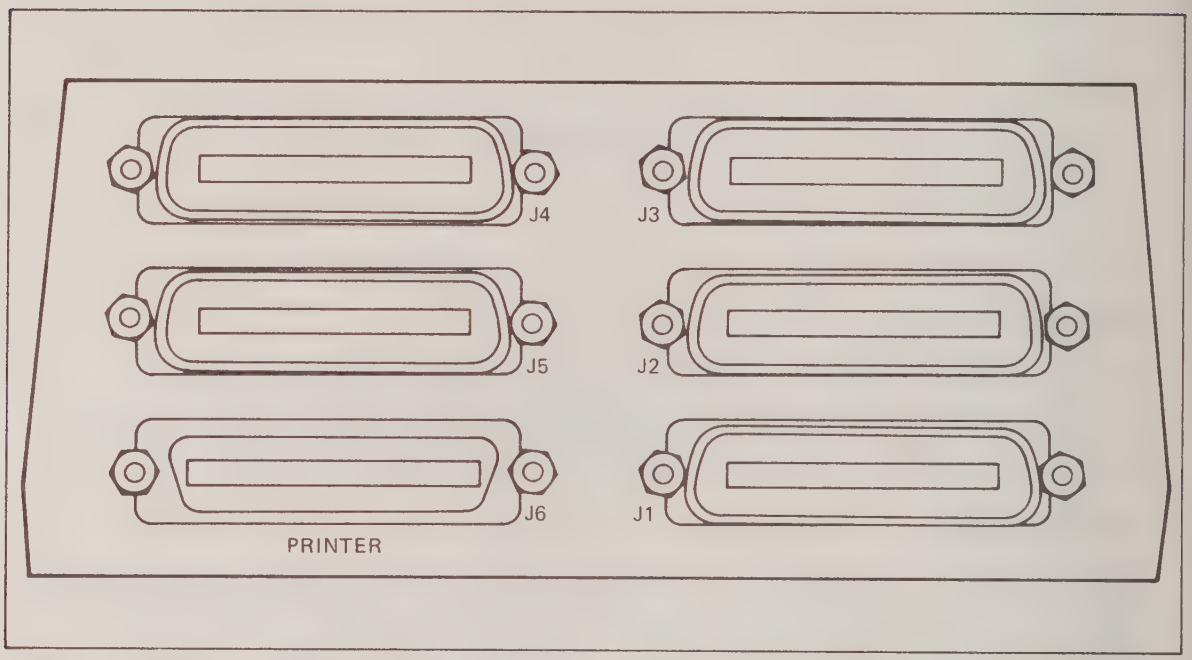
Size
: Style C PTI case with storage drawer.
10.49 cm H x 20.45 cm W x 32.64 cm D
(4.13 in. x 8.05 in. x 12.85 in.)

Protection Class
: Relates solely to insulation or grounding properties defined in IEC 348.

CONNECTOR LOCATIONS

Refer to Figure 17-20 for a diagram of the rear panel connector locations.

Figure 17-20. Rear Panel Connector Locations



Y2039 RTD 392 PROBE

INTRODUCTION

The Model Y2039 is a high quality 100 Ohm Platinum RTD Probe sold by the John Fluke Mfg. Co., Inc. as a temperature measuring accessory. The probe contains a coil of platinum wire which is mounted strainfree inside the metal sheath.

CAUTION: Handle the probe with care. Physical shocks can damage and/or cause the probe to change its resistance characteristics.

CAUTION: Do not allow the temperature at the lead-end of the probe to exceed 150°C. Temperatures above 150°C can melt the lead connections and damage the probe.

SPECIFICATIONS

Nominal Resistance
100 ±.1 ohm @ 0°C

Temperature Coefficient
.003922/ohm/°C nominal

Power Rating
50 mW max in 3 fps flowing water, induced error ±1°C

Temperature Range
-183°C to +480°C

Insulation Resistance, Platinum Element to Sheath
100 megohms minimum at 20°C, 10 megohms at 420°C.

Resistance Stability
12 milliohms/year maximum when exposed to 200°C; 20 milliohms maximum in 250 hours when exposed to 480°C; measured with probe at 0°C.

Sheath Material
Inconel

Leads
Teflon insulated, stranded copper, 22 AWG

Performance Standard
Conforms to IPTS-68 equations using the coefficients:

ALPHA = .0039221, DELTA = 1.493, within ±.03% of temperature (°C) over -50 to 420°C

Hysteresis
Less than 0.01°C at 200°C when using 0°C and 420°C as the end points.

Immersion Effects
The reading shall not vary more than .005°C when the probe immersion is varied between 4 and 10 inches in an ice bath.

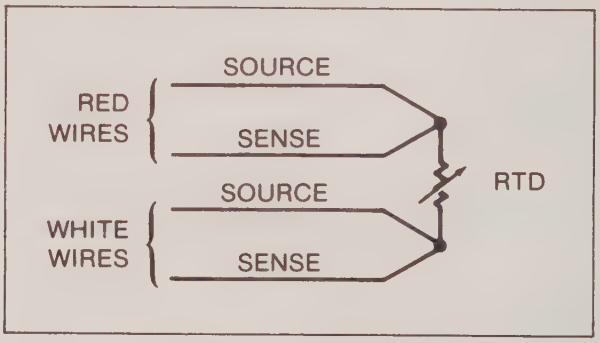
Thermoelectric Voltage
When tested in an ice bath with immersions from 4 to 10 inches, the thermoelectric voltage shall not exceed 2 microvolts.

Transition End Temperature
150°C maximum.

CONNECTION

The Y2039 is a four-wire RTD. Connect it as is shown in Figure 17-21.

Figure 17-21. Y2039 4-Wire RTD Connections



Configuration Examples

CONFIGURATION EXAMPLES

CASE 1: THERMOMETER AND SCANNER.

APPLICATION: TO AUTOMATICALLY SCAN UP TO 100 CHANNELS OF TEMPERATURE
Refer to Figure 18-1.

A. Configure 2300A

1. If using 2180A and 2300A-003 RTD Scanner cards:

   a. Select the proper RTD type from Table 6-4 and set dip switches S1 (RTD type for channels 0-4), and S2 (RTD type for channels 5-9). S1 and S2 are located at back of scanner card.

   b. If any channels are to be skipped in auto scan mode, set appropriate channel to be skipped using S3. S3 is located at the back of RTD scanner card.

   c. Connect RTD's to 2300A-003 RTD Scanner card(s). See Figure 6-2 in section 6 regarding RTD hookup procedures.

   d. Set S3 to skip any unused channels if desired. ON= Skipped.

   e. Install scanner cards into 2300A.

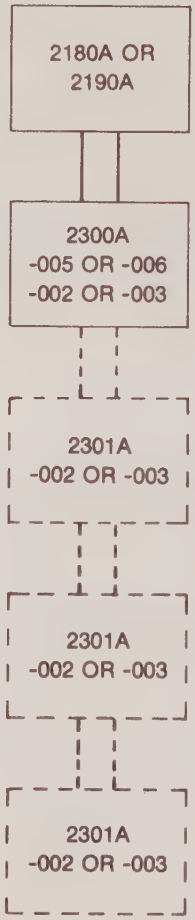
2. If using 2190A and 2300A-002 Thermocouple Scanner cards:

   a. Determine if 2190A is microprocessor type 1, 2, or 3. This can be determined by turning off the 2190A and then powering it back up. The number 1, 2, or 3 will appear to the right of the decimal point.

   b. Select proper T/C type from Table 7-3 and set dip switches S1 (T/C type for channels 0-4) and S2 (T/C type for channels 5-9). S1 and S2 are located at back of -002 scanner card.

   c. If any channels are to be skipped in the auto scan mode, set the appropriate channel to be skipped using S3. (ON = Skipped.) S3 is located towards the rear of the T/C scanner card.

Figure 18-1. Case 1: Thermometer and Scanner



(20 CHANNELS OF RTD OR THERMOCOUPLE, BUT NOT BOTH)

30 CHANNELS MAX

30 CHANNELS MAX

20 CHANNELS MAX

NOTES: 1. Maximum of 100 channels per system.
2. All cabling provided with instruments.

d. Connect the T/C's to the terminations provided corresponding to the unskipped channels.

e. Install the scanner cards in the scanner.

3. If using the 2301A Scanner Extenders:

a. Follow procedures A1. or A2.

b. Install scanner cards in 2301A.

c. No more than 100 channels per system maximum, and no more than three Scanner Extenders (2301A).

4. Note: There is no need to set the address or baud rate switches on the 2300A-005 or -006 interface card in this case's configuration.

B. Configure thermometer.

1. If using 2180A:

a. Pull out the RTD input module located at the rear of the 2180A and ensure that no RTD is attached.

b. Ignore the RTD type select switch on the input module as this does not affect the type select on the 2300A, except that the switch should not be set to 8 or 9.

c. Replace the RTD module. The input module MUST be in place in order for the system to operate.

2. If using 2190A:

a. Pull out T/C input module located at rear of 2190A and ensure that no T/C's are connected.

b. There is no need to set the T/C type select dip switch on the T/C input module, as T/C type select is accomplished on the 2300A Scanner card, except that the switch should not be set to 8 or 9.

c. Replace the T/C input module. It MUST be in place in order for the system to operate.

3. Note: The 21X0A-006 limits option may be installed and used in the thermometer. However, the same limit comparison will be performed on each channel scanned by the 2300A or 2301A.

C. Connect System

1. Connect the grey accessory cable attached to the 2300A to the thermometer's accessory connector, located at the rear of the thermometer under the fuse access.

2. If a 2301A is used, connect the grey accessory cable from the 2301A to the 2300A's accessory connector located at the rear of the 2300A, to the right of the fuse access.

3. If multiple 2301A's are used, connect the grey accessory cable for one extender to the accessory connector of the previous 2301A in a daisy chain configuration.

D. Power Up Sequence

1. Attach the power cords to the thermometer and to the 2300A scanner mainframe.

2. Each scanner extender chassis derives its power from the 2300A so no other power connections are necessary.

3. Note: A Y2024 3-way power cord can be ordered separately if multiple mainframe instruments are to be stacked and latched together.

4. Turn the thermometer and scanner on. Refer to the manuals of the separate instruments for operating instructions.

CASE 2: THERMOMETER AND PRINTER

A. Using the 2020A Printer with -004 Interface Option
Refer to Figure 18-2.

1. The 2180A or 2190A Thermometer in use must have a 21X0A-002 Output option installed.

2. Select address 1, 6, 7, 8, or 9 on the address select switch (S3) of the 21X0A-002 board. This will require removing the thermometer's top cover. S2 (function select) should be set to "0" for normal operation.

3. Connect the thermocouple or RTD sensor being used to the input module of the thermometer, observing the polarity conventions. Select the proper linearization by referring to the thermometer's manual, or the section in this guide pertaining to the appropriate instrument. See Table 7-3 in this guide for the thermocouple type select codes, or Table 6-4 for the RTD type select codes.

4. Connect the Y7203 or Y7204 PTI ribbon cable from the thermometer's data output connector to the printer's data input connector.

5. Connect power cords and turn on units.

B. Using the 2030A Computing Printer.
Refer to Figure 18-3.

1. Follow the same instructions as given in case 2A.

2. Since the 2030A allows the data format/interface mode of channels 7, 8, or 9 to be selectable, ensure that S1, S2, and S3 (corresponding to channels 7, 8, and 9, respectively) are set to a format of Parallel ASCII/Handshake (e.g., 1, 6, 7, 8, or 9). All three switches may be set to the same value.

3. The address set on the thermometer's 21X0A-002 Output option board is the SPECIAL ADDRESS which must be set on the 2030A in order to implement certain print functions or modes. See the section in this guide pertaining to programming the 2030A.

Figure 18-2. Case 2A: Thermometer and 2020A Printer with -004

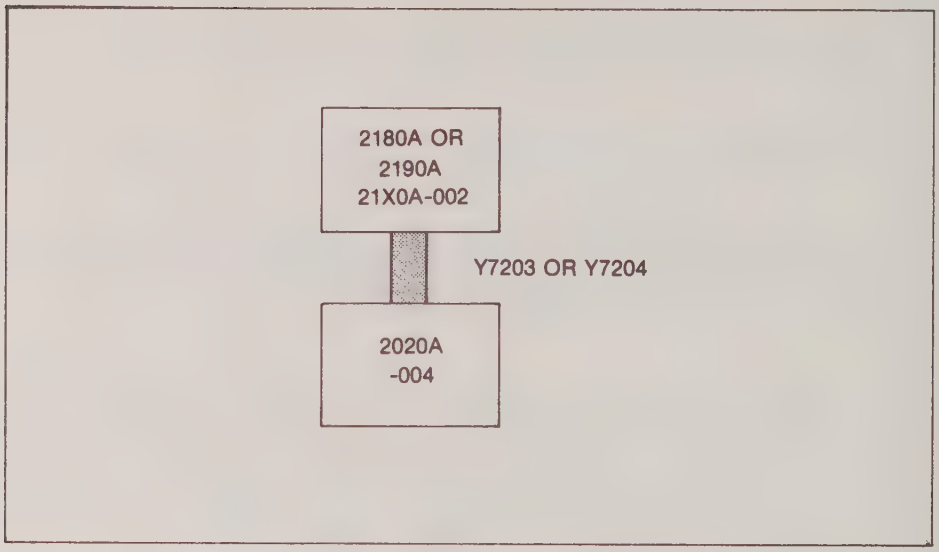
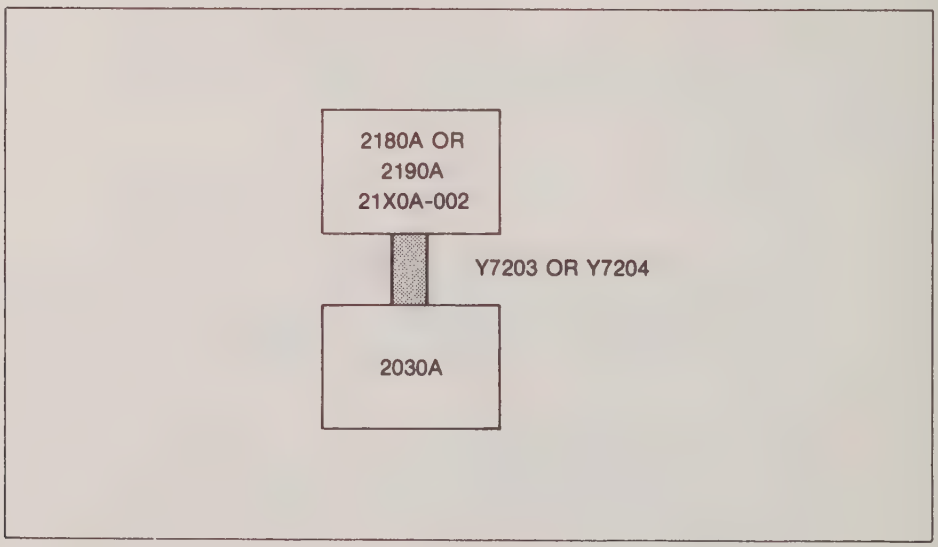


Figure 18-3. Case 2B: Thermometer and 2030A Printer



CASE 3: THERMOMETER, SCANNER AND PRINTER.

APPLICATION: TO AUTOMATICALLY SCAN AND LOG TEMPERATURE DATA

3A. Using 2020A Universal Printer
Refer to Figure 18-4.

1. Follow exact procedure as in Case 1, except:

   a. Set S2 Address switch on the 2300A-005 or 2300A-006 Interface card to address 1, 6, 7, 8, or 9. S2 is the leftmost of the 2 dip switches located in a corner of the interface. To view switches, remove all scanner cards.

2. Attach the PTI interface cable (Y7203 or Y7204) from the data input connector on the 2020A printer to the data I/O connector of the 2300A Scanner mainframe, located just above the fuse access.

3. Power up the thermometer, scanner mainframe and printer. See the 2020A manual for operating instructions.

4. If the 2020A has an interval print option (2020A-006) installed, then select the appropriate interval. This interval will control how frequently the scanner will begin to output data to the printer, although the channel delay selected on the 2300A will control how fast the 2300A will scan each channel of temperature.

3B. Using a 2030A Computing Printer.
Refer to Figure 18-5.

1. Follow the exact procedure as Case 3A, ignoring paragraph 3A-4.

2. See the 2030A manual or this guide for operating and programming instructions. Please note that the SPECIAL ADDRESS function should be set to the address selected on the 2300A in step 3A-1a.

Figure 18-4. Case 3A: Thermometer, Scanner, and 2020A Printer with -004

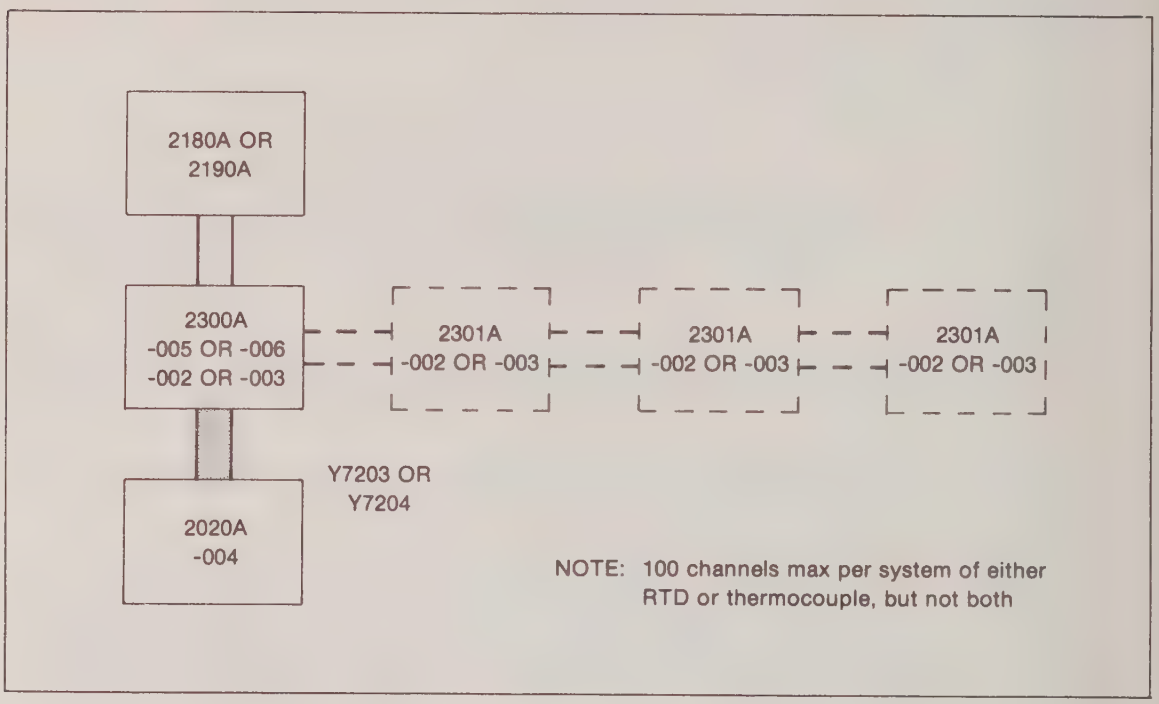
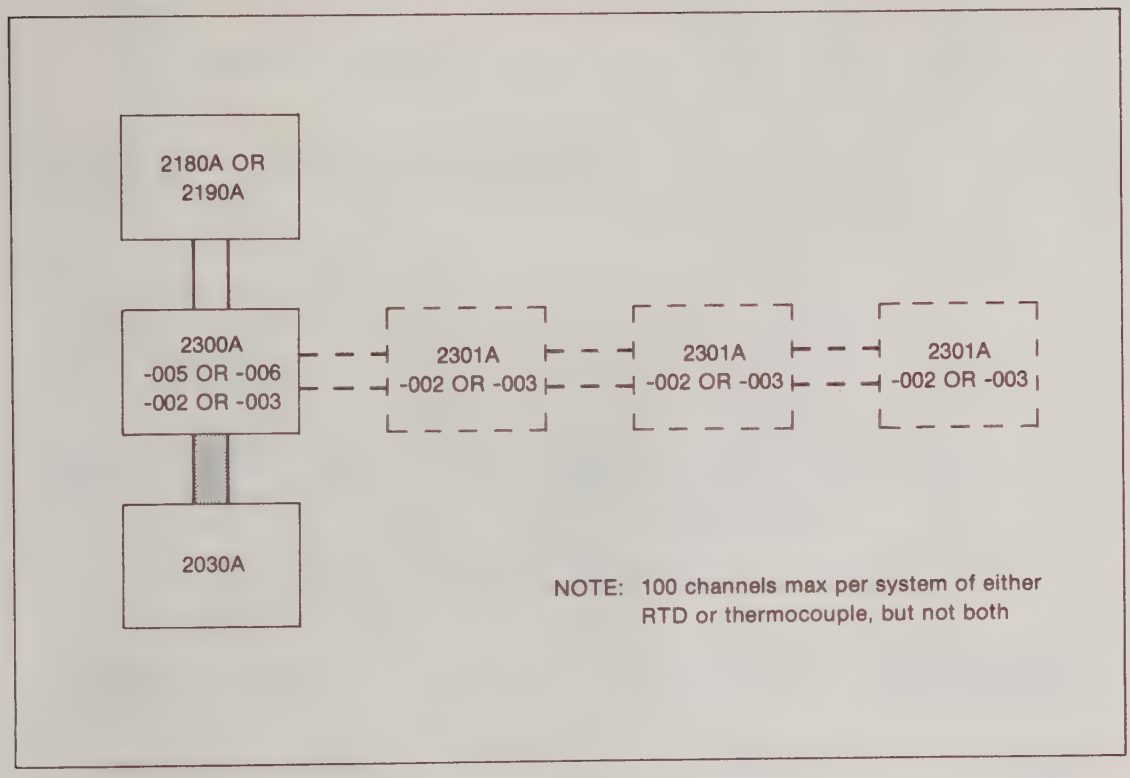


Figure 18-5. Case 3B: Thermometer, Scanner, and 2030A Printer



CASE 4: MULTIPLE TEST INSTRUMENTS CONNECTED TO ONE PRINTER

4A. Using the 2020A Printer with -004 PTI Interface Option Refer to Figure 18-6.

1. Ensure that each instrument has the required options installed. Configure each test instrument to be attached to the printer.

2. Address Selection

   a. Valid PTI Interface Addresses are 1-9, per Table 18-1. Note that since the Fluke thermometers, printers, and scanners use a handshake/Parallel ASCII data format, ONLY ADDRESSES 1, 6, 7, 8, OR 9 ARE VALID ADDRESSES. Therefore, a maximum of 5 temperature measurement instruments may be connected to a 2020A, if each system or device uses a different address. The other instrument addresses are dedicated to data formats unique to other Fluke instruments.

Table 18-1. PTI System Interface Addresses

ADDRESS BINARY	ADDRESS HEX	DATA FORMAT	INTERFACE MODE
0000	0	None	PTI System Reset
0001	1	Parallel ASCII	Handshake
0010	2	7250A,7260A,7261A W/521	Clocked
0011	3	7220A W/521 Option	Clocked
0100	4	8920A W/521 Option	Clocked
0101	5	8600A, 8800A W/521 Option	Clocked
0110	6	Parallel ASCII	Handshake
0111	7	Parallel ASCII	Handshake
1000	8	Parallel ASCII	Handshake
1001	9	Parallel ASCII	Handshake
1111	F	None	All Instruments Off

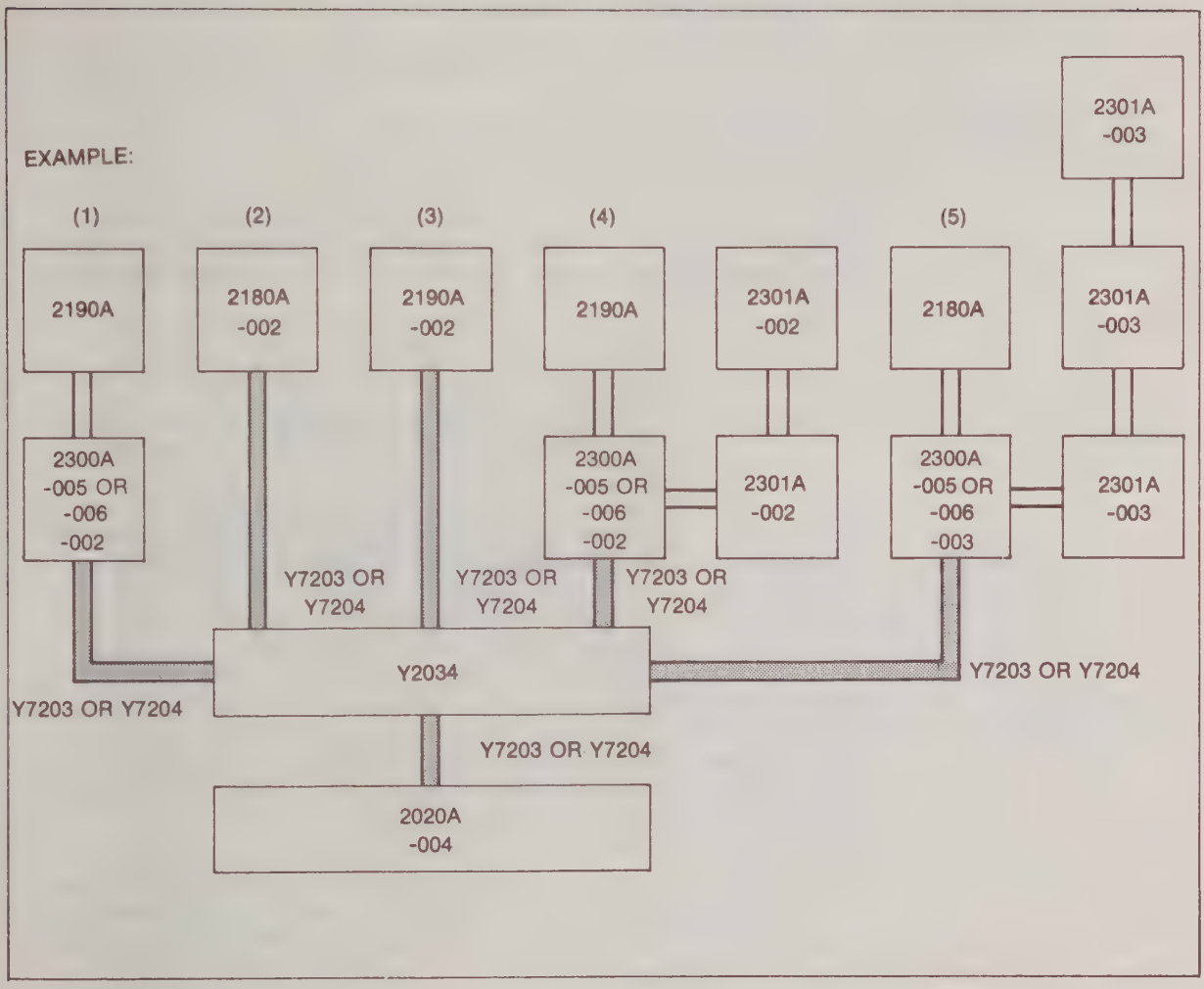
   b. Address selection must be made on the interface card of each test instrument. Referring to Figure 18-6, each of the numbered systems connected to the printer would have their addresses set in the following way:

      (1) S2 on the 2300A's interface card set to "1" (ON OFF OFF OFF)

      (2) S3, located on the 21X0A-002 card, set to "6" (OFF ON ON OFF)

      (3) S3, located on the 21X0A-002 card, set to "7" (ON ON ON OFF)

Figure 18-6. Case 4A: Multiple Test Instruments Connected to 2020A



(4) S2 on the 2300A's interface card set to "8" (OFF OFF OFF ON)

(5) S2 on the 2300A's interface board set to "9" (ON OFF OFF ON)

3. Connect System

a. Each numbered system in the case example given must be properly configured and hooked-up. To configure, refer to the case examples noted and follow the instructions given in each one.

System (1) Case 1

System (2) Follow the instructions for configuring the thermometer given in Case 2A, paragraphs 1-3.

System (3) Follow the instructions for configuring the thermometer given in Case 2A, paragraphs 1-3.

System (4) Case 1

System (5) Case 1

b. Using either the Y7203 or Y7204 PTI cable, attach one end to the data I/O connector of each of the test instruments. For the following numbered systems:

(1) Attach one end of the PTI cable to the 2300A's Data I/O connector, and the other to one of the input connectors of the Y2034 Multi-Instrument Interconnect Accessory.

(2) Attach one end of the PTI cable to the 21X0A-002 Output connector located on the rear of the thermometer. Connect the other end of the cable to one of the input connectors of the Y2034 Multi-Instrument Interconnect Accessory.

(3) Attach one end of the PTI cable to the 21X0A-002 Output connector located on the rear of the thermometer. Connect the other end of the cable to one of the input connectors of the Y2034 Multi-Instrument Interconnect Accessory.

(4) Attach one end of the PTI cable to the 2300A's Data I/O connector, and the other to one of the input connectors of the Y2034 Multi-Instrument Interconnect Accessory.

(5) Attach one end of the PTI cable to the 2300A's Data I/O connector, and the other to one of the input connectors of the Y2034 Multi-Instrument Interconnect Accessory.

c. Connect one end of another Y7203 or Y7204 to the output connector of the Y2034 and the other end to the data input connector of the 2020A-004.

d. Power up all units.

4B. Using the 2030A Computing Printer
Refer to Figure 18-7.

1. Configure each test instrument or system to be connected to the printer.

2. Address Selection

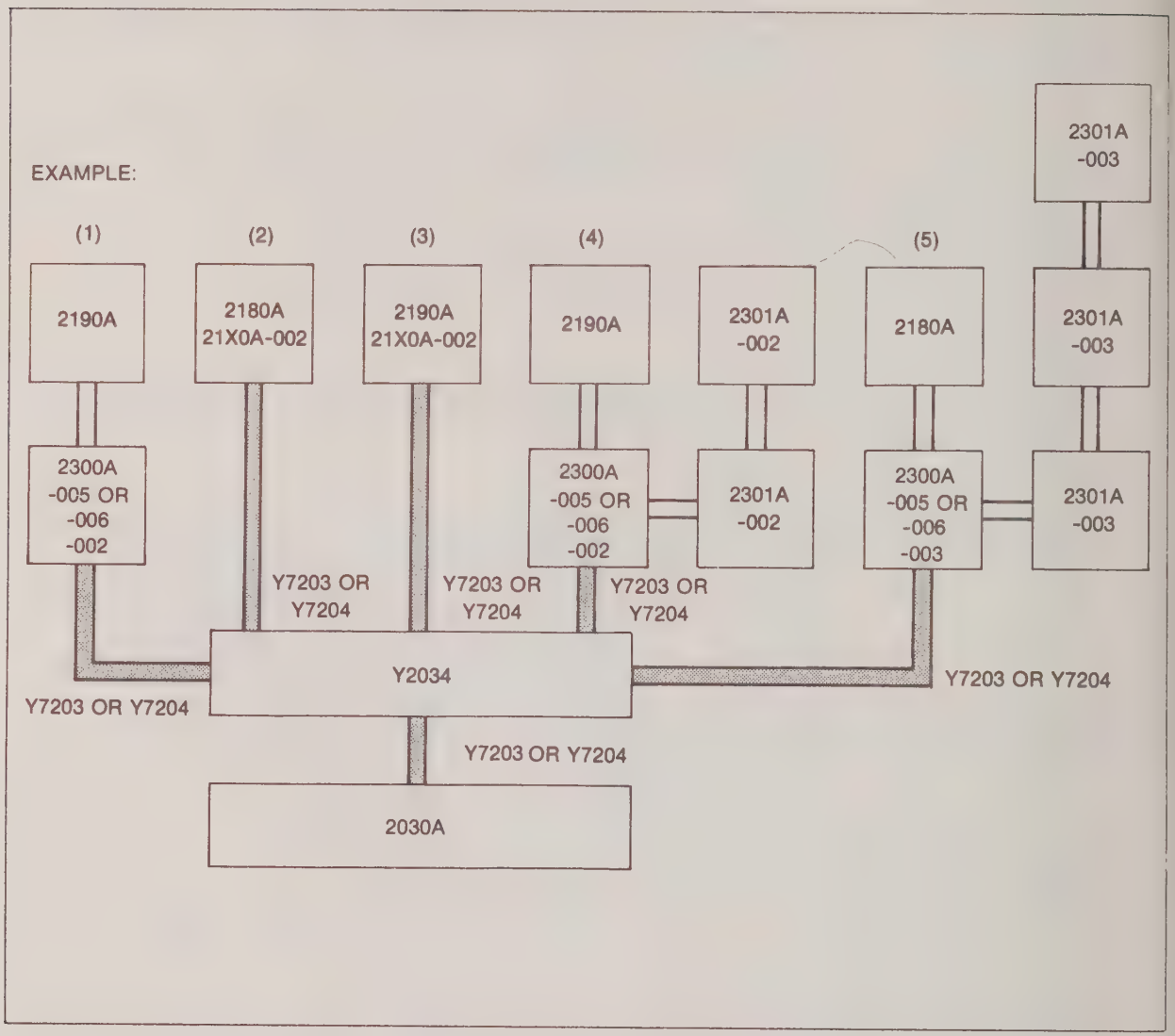
a. Valid PTI Interface addresses are 1-9, per Table 18-2. Note that since Fluke PTI thermometry instrumentation (2180A, 2190A, 2300A) uses a handshake/Parallel ASCII data format, ONLY ADDRESSES 1, 6, 7, 8, OR 9 ARE VALID ADDRESSES. Therefore, a maximum of five temperature measurement instruments may be connected to a 2030A at any one time via a Y2034 Interconnect Accessory. The other addresses are dedicated to data formats unique to other Fluke instruments.

Table 18-2. PTI System Interface Addresses

ADDRESS		DATA FORMAT	INTERFACE MODE
BINARY	HEX		
0000	0	None	PTI System Reset
0001	1	Parallel ASCII	Handshake
0010	2	7250A,7260A,7261A W/521	Clocked
0011	3	7220A W/521 Option	Clocked
0100	4	8920A W/521 Option	Clocked
0101	5	8600A, 8800A W/521 Option	Clocked
0110	6	Parallel ASCII	Handshake
0111	7	*Parallel ASCII	Handshake
1000	8	*Parallel ASCII	Handshake
1001	9	*Parallel ASCII	Handshake
1111	F	None	All Instruments Off

*Data formats and interface modes 1-9 are switch selectable on addresses 7-9.

Figure 18-7. Case 4B: Multiple Test Instruments Connected to 2030A



b. Address selection must be made on the interface card of each test instrument. Follow the instructions given for address selection given in Case 4A, paragraphs 2b.(1)-(5).

c. Like the 2020A, the 2030A has 9 addresses which it will interrogate using a given data format and interface mode. Unlike the 2020A, the 2030A has 3 of the 9 addresses positions which can accept any of the allowed data formats. Addresses 7, 8, and 9 are format-selectable by switches S1, S2, and S3, respectively. These switches are located on the 2030A's interface board. Since all Fluke thermometry instrumentation requires the Parallel ASCII/Handshake format, S1, S2, and S3 should be set to 1, 6, 7, 8, or 9. They may all be set to the same number.

3. Connect System

Perform this task as outlined in Case 4A, section 3, substituting the word 2030A wherever the 2020A and -004 Option are mentioned.

4. NOTE: The PTI address set on each test instrument is the SPECIAL ADDRESS which must be set in order to use the trace, limit, or math modes of the 2030A Computing Printer. See the section in this guide referring to 2030A programming.

CASE 5: THERMOMETER AND RS-232 DEVICE.
Refer to Figure 18-8.

A. Configure thermometer.

1. The 2180A or 2190A thermometer in use must have the 21X0A-002 Output Option installed.

2. Set S1 on the 21X0A-002 to the appropriate baud rate of the RS-232 device in use. See Table 18-3 for baud rate select switch settings.

Table 18-3. Baud Rate Select Switch S1

SWITCH POSITION	BAUD RATE SELECT SWITCH S1				BAUD RATE
	1	2	3	4	
0	OFF	OFF	OFF	OFF	110
1	ON	OFF	OFF	OFF	150
2	OFF	ON	OFF	OFF	300
3	ON	ON	OFF	OFF	600
4	OFF	OFF	ON	OFF	1200
5	ON	OFF	ON	OFF	2400
6	OFF	ON	ON	OFF	4800
7	ON	ON	ON	OFF	9600
8	OFF	OFF	OFF	ON	110
9	ON	OFF	OFF	ON	150

3. Set S2 on the 21X0A-002 board to "0."

4. Hook up the thermocouple or RTD sensor to the input module of the thermometer, being careful to observe the polarity conventions.

5. Select the proper RTD or thermocouple type linearization by using the dip switch located on the input module. Refer to Table 7-3 for the type select switch settings for thermocouples, or to Table 6-4 for RTD type select codes.

6. If you are using a 2180A, set S2 to AUTO and S3 to MANUAL on the RTD input module.

B. Configure Y2026B

1. Attach the ribbon cable provided with the Y2026B (Y7203) from the data output connector located at the rear of the thermometer to J3 on the Y2026B.

2. Attach the RS232 cable, the Y1707, to either J1 or J2. (They are both in parallel.)

3. Set the slide switches on the Y2026B to correspond to the pin configuration required for the RS-232 device in use. Consult the device's manual for details of pin configuration. Typical Control line switch settings are outlined in Table 18-4.

Figure 18-8. Case 5: Thermometer and RS-232 Device

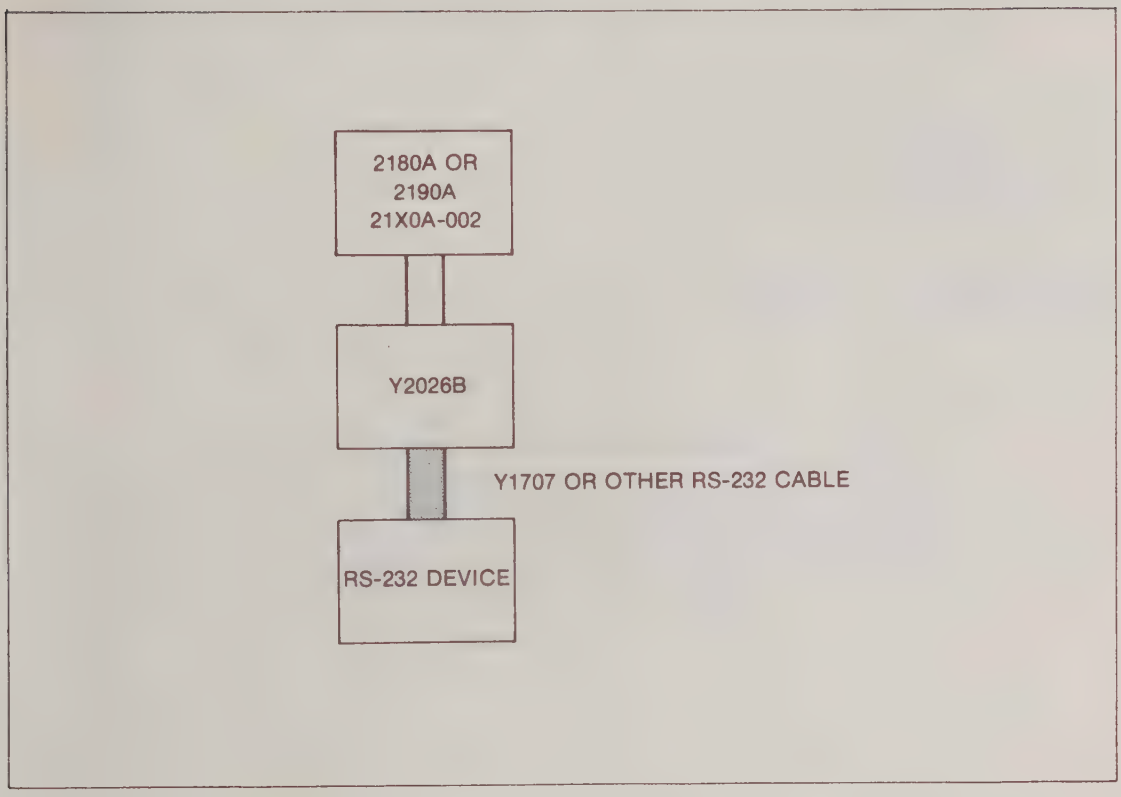


Table 18-4. Typical Control Line Switch Settings

COMMUNICATION TYPE	SWITCH SETTINGS			
	DTR (S1)	DSR (S2)	CTS (S3)	Scanner Busy (S4)
RS-232 Terminal to and from 2180A/2190A-002	To DSR	Through	Pulled-up	Don't Care
RS-232 Modem to and from 2180A/2190A-002	To DSR	Through	Through	Don't Care

4. NOTE: A continuous data output from the thermometer, without regard for the control input at J1 and J2, can be established by setting both the CLEAR TO SEND and the DATA SET READY switches to the PULLED-UP position. Both control lines, with the switches set to PULLED-UP, are held at a high logic level through resistors in the thermometer.

CASE 6: THERMOMETER, SCANNER, AND RS-232 DEVICE
Refer to Figure 18-9.

A. Configure thermometer and scanner.

1. Follow instructions given in Case 1 exactly, but in addition:

a. Set S1 on the 2300A -005 or -006 interface board to the appropriate baud rate of the RS-232 device in use.

B. Configure Y2026B

1. Attach the ribbon cable (Y7203) provided with the Y2026B RS-232 adapter from J3 on the Y2026B to the data I/O connector of the 2300A Scanner Interface card.

2. Attach the RS-232 cable (Y1707) from the RS-232 device to the Y2026B (either J1 or J2).

3. Set the switches on the Y2026B to correspond to the pin configuration required for the RS-232 device in use. Consult the device's manual for details of pin configuration. Typical control line switch settings are shown in Table 18-5.

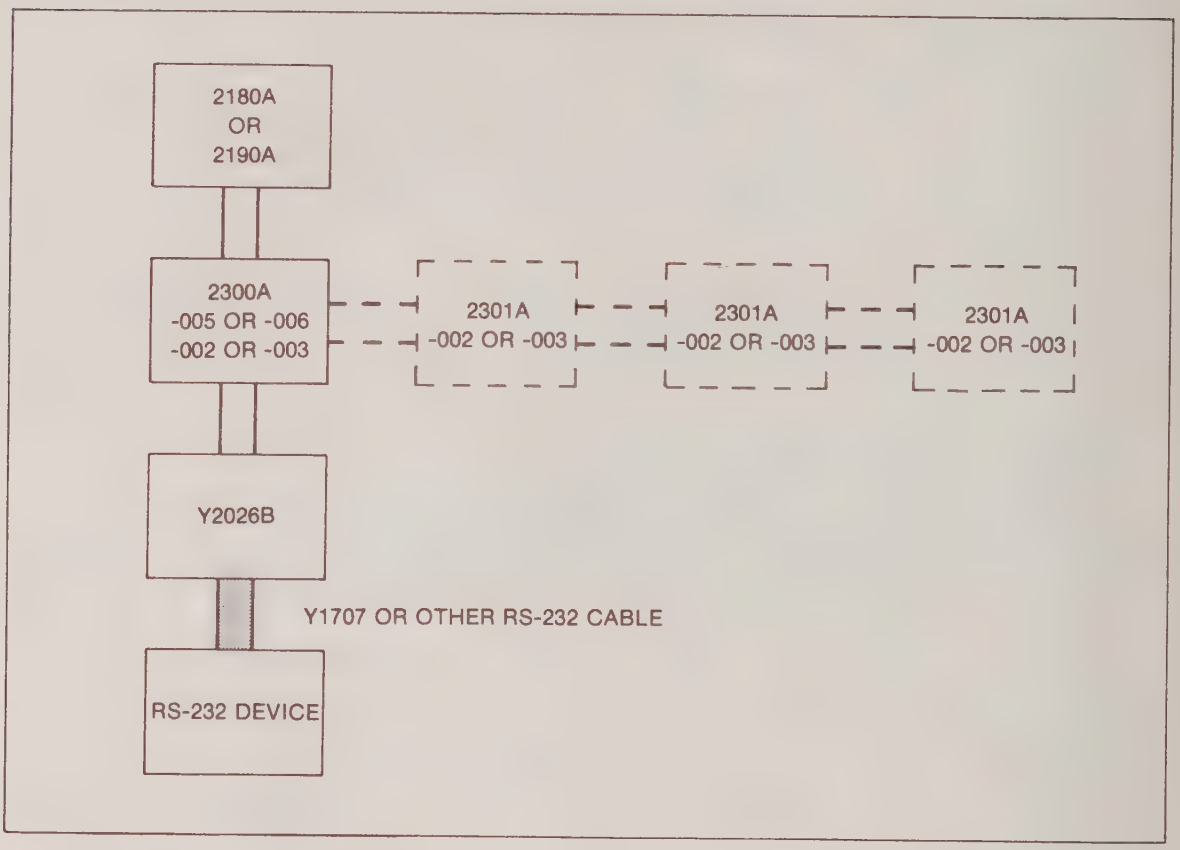
Table 18-5. Typical Control Line Switch Settings

COMMUNICATION TYPE	SWITCH SETTINGS			
	DTR (S1)	DSR (S2)	CTS (S3)	Scanner Busy (S4)
RS-232 Terminal to and from 2300A Scanner	To DSR	Pulled-up	Pulled-up	To CTS
RS-232 Modem to and from 2300A Scanner	Through	Through	Through	Through

4. NOTE: A continuous data output from the scanner, without regard for the control input at J1 and J2, can be established by setting both the CLEAR TO SEND and the DATA SET READY switches to the PULLED-UP position. Both control lines, with the switches set to PULLED-UP, are held at a high logic level through resistors in the scanner.

5. NOTE: If you are using a 2300A with a -006 interface option, then it is possible to remotely control the scanner/thermometer system using the remote control commands given in the 2300A manual. The 2300A-005 Interface option is an output only device, so no remote control is possible.

Figure 18-9. Case 6: Thermometer, Scanner, and RS-232 Device



CASE 7: THERMOMETER, SCANNER, AND 1720A (RS-232).
Refer to Figure 18-10.

A. Configure thermometer and scanner.

1. Follow the instructions given in Case 6, section A.

B. Configure Y2026B

1. Attach the ribbon cable (Y7203) provided with the Y2026B RS-232 adapter from J3 on the Y2026B to the data I/O connector of the 2300A.

2. Attach the Y1707 RS-232 cable from the KB1: RS-232 port on the 1720A to J2 on the Y2026B.

3. Set the switches on the Y2026B as follows:

a. Data Terminal Ready (DTR)--To DSR

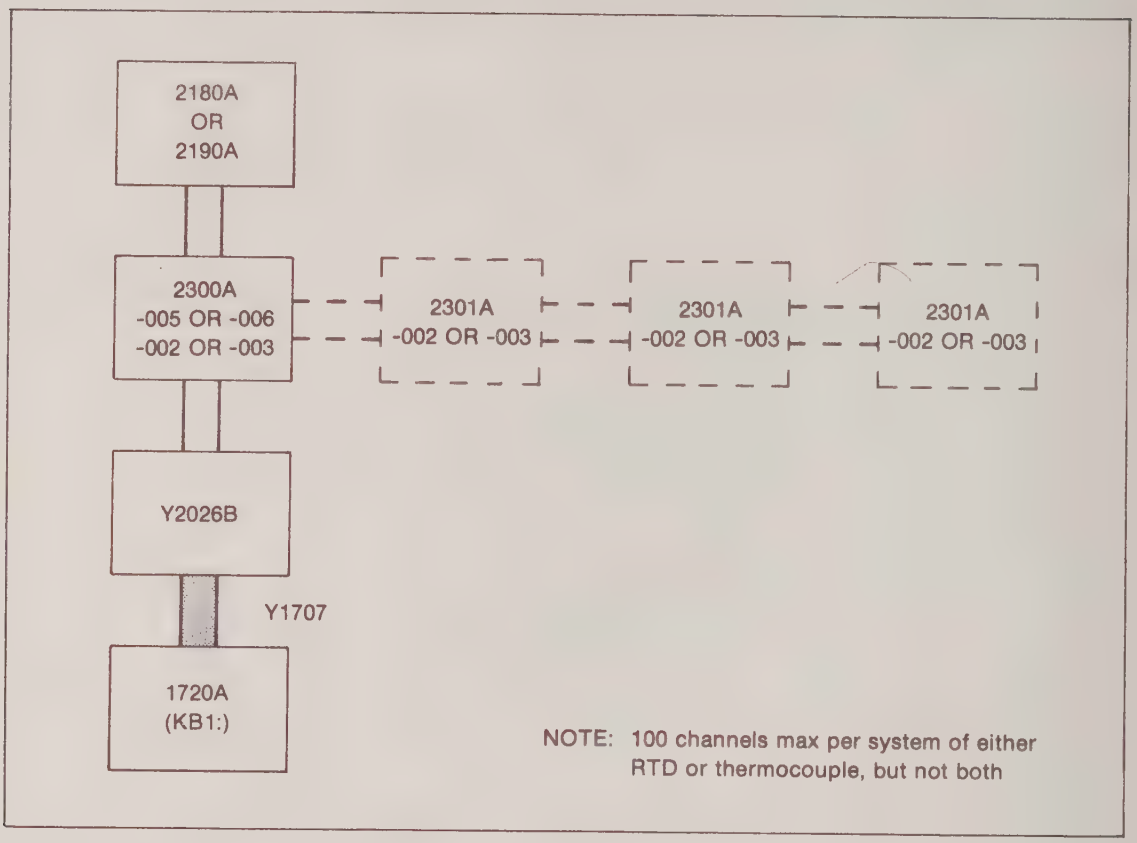
b. Data Set Ready (DSR)--Pulled Up

c. Clear To Send (CTS)--Pulled Up

d. Scanner Busy--To CTS

e. Transmitted Data Line--on J2 Pin #3

Figure 18-10. Case 7: Thermometer, Scanner, and 1720A (RS-232)



B. Programming Example Using 1720A to Remotely Control 2300A Scanner.

```
10   Close 1%, 2%, 3% ! ensure files not open to avoid error
20   Open 'kb1:' as new file 1% !output to 2300A
30   Open 'kb1:' as old file 2% !input from 2300A
40   Open 'kb0:' as old file 3% !input from keyboard
50   E$=chr$(27%) !escape character <ESC>
60   R$=chr$(13%) !carriage return <cr> character
70   On #2 Goto 110 !enable interrupt from 2300A
80   On #3 Goto 180 !enable interrupt from keyboard
90   Goto 90 !wait for keyboard or 2300A input interrupt to occur
100  !----INTERRUPT FROM 2300A----
110       OFF #3% !disable keyboard interrupt
120       Input Line #2%, I$ !take reading, etc. from 2300A
130       If I$=E$ Then  I$='Escape'\Goto 150 !identify an ESC
140       If I$<' ' Then I$='<'+NUM$(ASCII(I$))+'>' !non-prnt char
150       Print '~';I$;'~' !display what was received
160       Resume 80 !reenable keyboard interrupts
170  !----INTERRUPT FROM KEYBOARD-----
180       OFF #2% !disable 2300A interrupt
190       Input Line #3%, I$ !take input from keyboard
200       Print #1%, I$; !send it to 2300A without <cr> or <lf>
210       If I$<>E$ Then Print #1%, R$; !send <cr> if not ESC
220       Resume 70 ! reenable 2300A interrupt
230  End
```

CASE 8: THERMOMETER, 1120A IEEE TRANSLATOR, AND IEEE-488 DEVICE
Refer to Figure 18-11.

A. Configure Thermometer

1. The 2180A or 2190A digital thermometer must be equipped with the 21X0A-002 Output option.

2. Set the baud rate switch on the 21X0A-002 board (S1) to 2400 baud (ON OFF ON OFF).

3. Set S2 to Operate, position 0.

4. S3 (Address select) is for use with addressable PTI instruments and need not be set for this application.

5. If you are using a 2190A, ensure that the thermocouple is attached to input terminals and that dip switch is set to proper thermocouple type. Refer to Table 7-3 for thermocouple type selection codes.

6. If you are using a 2180A, ensure that the RTD is attached to the terminal blocks on the RTD input module, and that S2 is set to AUTO, S3 is set to MANUAL, and that S1 is set to the proper RTD type. Refer to Table 6-4 for RTD type selection codes.

B. Configure 1120A.

1. Install the -522 Personality card into an available slot in the 1120A per installation instructions given in the unit's manual. Note which slot you are using as this will determine the two least significant bits of the IEEE-488 address on the -522 card.

2. Set S1 and S2 on the -522 card to correspond to the desired SRQ mode. See Table 18-6.

Table 18-6. SRQ Mode Select Switches

S1	S2	SRQ MODE
ON	OFF	SRQ on Line Feed
OFF	ON	SRQ on Buffer Full
ON	ON	SRQ on Line Feed or Buffer Full*
OFF	OFF	No SRQ
*Typically used		

3. Set the address switches on the front of the 1120A to correspond to the IEEE address desired. This will vary depending on the number of other instruments which may be attached to the controller. A list of usable IEEE addresses for the 1120A can be found in Table 18-7.

Figure 18-11. Case 8: Thermometer, 1120A, and IEEE-488 Device

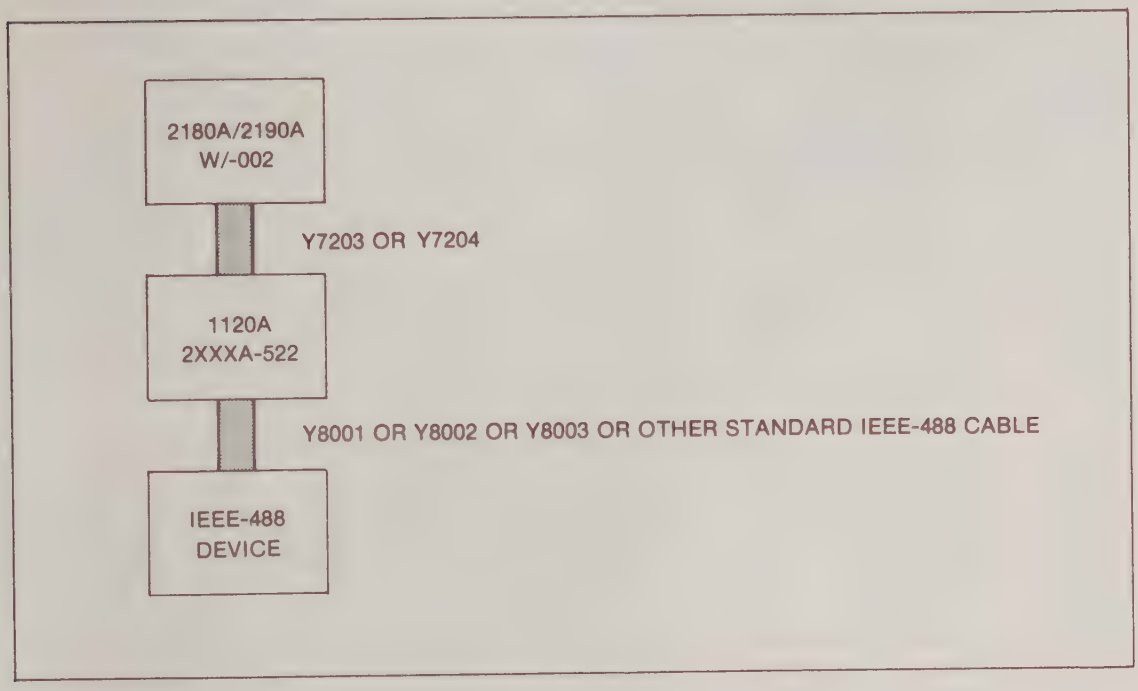


Table 18-7. IEEE-488 Addresses

Decimal Number Address	Equivalent ASCII Character		Primary IEEE Address					PCB Position * 1=Leftmost 2=Middle 3=Rightmost
			Front Panel Switches			Determined by PCB Position		
	Talk	Listen	A5	A4	A3	A2	A1	
0	@	SP				0	0	1
1	A	!	0	0	0	0	1	2
2	B	"				1	0	3
4	D	S				0	0	1
5	E	%	0	0	1	0	1	2
6	F	&				1	0	3
8	H	(				0	0	1
9	I	)	0	1	0	0	1	2
10	J	*				1	0	3
12	L	'				0	0	1
13	M	_	0	1	1	0	1	2
14	N	.				1	0	3
16	P	0				0	0	1
17	Q	1	1	0	0	0	1	2
18	R	2				1	0	3
20	T	4				0	0	1
21	U	5	1	0	1	0	1	2
22	V	6				1	0	3
24	X	8				0	0	1
25	Y	9	1	1	0	0	1	2
26	Z	:				1	0	3
28	\	<				0	0	1
29	]	=	1	1	1	0	1	2
30	^	>				1	0	3

*PCB position is defined from an observer facing the front of the 1120A.

a. Suppose that address 13 were available for use. Setting address 13 on the 1120A requires that front panel switches be set as follows: A5=0, A4=1, A3=1.

b. Position selectable address lines A2 and A1 must be set to A2=0, A1=1. This is accomplished by having the -522 Personality card in the center slot. (Facing the front of the 1120A, A2 and A1 =0/0 corresponds to the leftmost slot, 0/1 corresponds to the center slot, and 1/0 corresponds to the rightmost slot.)

C. Connect System

1. Attach the PTI cable (Y7203, Y7204) from the data output connector of the thermometer to the input connector of the -522 card installed in the rear of the 1120A.

2. Attach the IEEE-488 cable from the output connector of the 1120A to the connector of the IEEE controller.

3. Power up both units and begin operation.

4. Note: The 2180A or 2190A is not remotely controllable and hence will operate in a talk-only mode.

CASE 9: THERMOMETER, SCANNER, AND IEEE-488 TRANSLATOR, AND CONTROLLER. Refer to Figure 18-12.

A. Configure Thermometer

1. If using a 2180A RTD thermometer, ensure that no RTD's are attached to the input module. S2 should be set to AUTO, S3 to MANUAL, and S1 to anything except 8 or 9. (RTD type selection is done on the 2300A.)

2. If using a 2190A Thermocouple thermometer, ensure that no thermocouples are attached to the input module. Thermocouple type select switch S1 may be set to anything except 8 or 9. (Thermocouple type selection is done on the 2300A.)

B. Configure 2300A Scanner

1. If using -002 Thermocouple Scanner cards:
   a. Attach thermocouples to the Scanner card(s).

   b. Set S1 and S2 to correspond to the thermocouple types in use. S1 sets the thermocouple type for channels 0-4; S2 sets the thermocouple type for channels 5-9. The switch settings for the various microprocessor types and thermocouple types are given in Table 7-3.

   c. Set S3 to automatically skip any unused channels, if desired. ON = Skipped.

   d. Insert scanner cards into the 2300A or 2301A.

2. If using -003 RTD/OHMS Scanner cards:

   a. Attach RTD's to Scanner card(s).

   b. Set S1 and S2 to correspond to the RTD types in use. S1 sets the RTD type for channels 0-4; S2 sets the type for channels 5-9. See Table 6-4 for RTD type selection codes.

   c. Set S3 to automatically skip any unused channels, if desired. ON = Skipped.

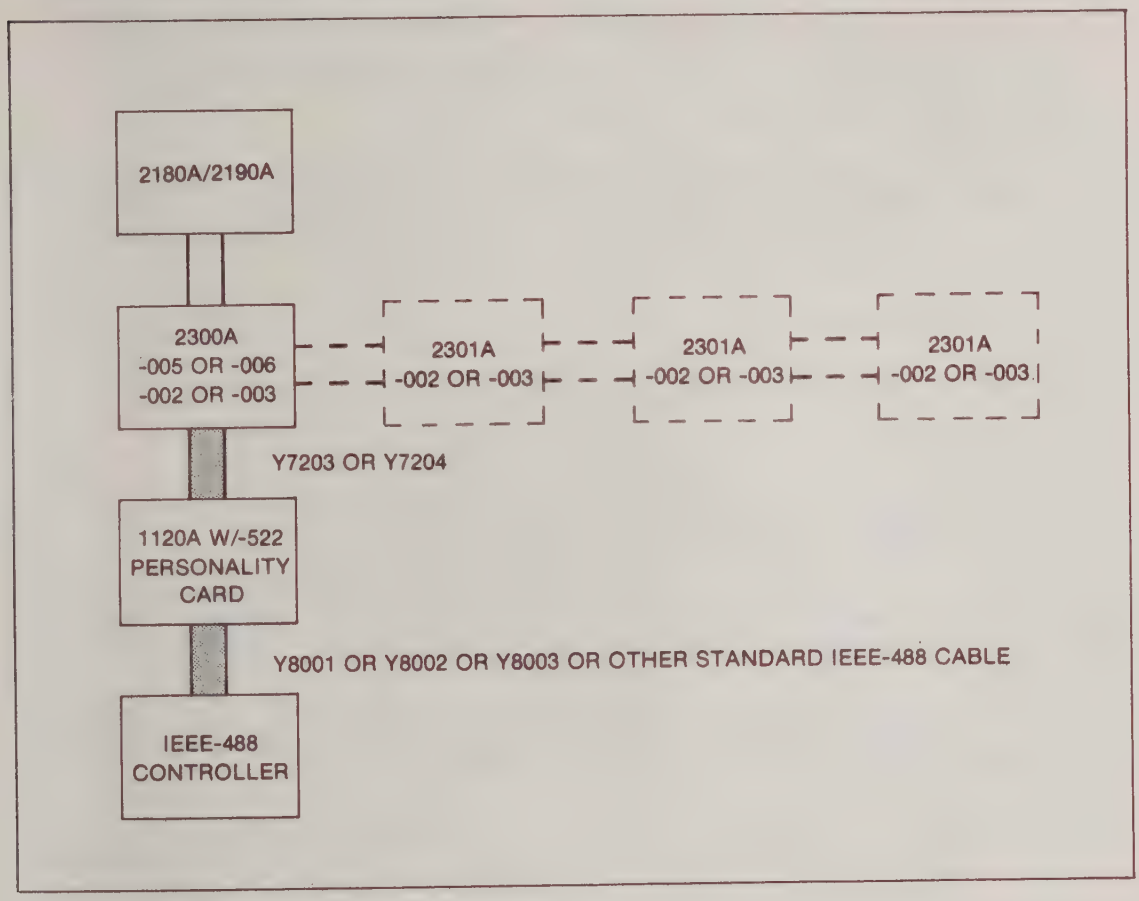
   d. Insert scanner cards into the 2300A or 2301A.

3. If using the -005 Interface option:

   a. Note: No remote control of the scanner is possible using this interface, and the scanner will operate in a talk only mode.

   b. Set S1 (baud rate select) to 2400 baud (ON OFF ON OFF). (Note: S1 is the rightmost switch inside the 2300A on the interface board as seen from rear of Scanner. To view, remove all scanner cards.)

Figure 18-12. Case 9: Thermometer, Scanner, 1120A and IEEE-488 Device



4. If using the -006 Remote Control Interface Option:

   a. NOTE: Using this option, remote control of the scanner system is possible. See the programming hints in the 2300A-006 section for further information on remotely controlling the 2300A.

   b. Set S1 (Baud Rate Select) to 2400 Baud (ON OFF ON OFF). (Note: S1 is rightmost switch inside 2300A on the interface board as seen from the rear of the Scanner. To view, remove all the scanner cards).

C. Configure 1120A.

   1. Follow instructions given in 7B.

D. System Hookup.

   1. Connect the grey accessory cable attached to the 2300A to the accessory connector on the thermometer.

   2. If using one or more 2301A Scanner Extenders, connect the grey accessory cable from the 2301A to the 2300A, and any additional 2301A cables to the previous 2301A.

   3. Attach a Y7203 or Y7204 PTI cable from the data I/O connector on the rear of the 2300A to the input connector of the -522 card installed in the 1120A.

   4. Connect the IEEE-488 bus cable Y8001, Y8002, or Y8003 to the IEEE connector on the rear of the 1120A to the IEEE controlling device.

   5. Power up Thermometer, Scanner, and 1120A.

CASE 10: THERMOMETER, SCANNER, 1120A TRANSLATOR AND FLUKE 1720A INSTRUMENT CONTROLLER (IEEE PORT)

Refer to Figure 18-13.

A. Configure Thermometer

1. If using 2180A:

   a. Ensure that no RTD's are attached to input module.

   b. S2 should be set to AUTO.

   c. S3 should be set to MAN.

   d. S1 may be anything except 8 or 9. (RTD type selection is done on the 2300A).

   e. The input module must be in place in the thermometer.

2. If using 2190A:

   a. Ensure that no thermocouples are attached to the thermocouple input module.

   b. Thermocouple type select switch S1 may be set to anything except 8 or 9. Thermocouple type selection is done on the 2300A).

   c. The input module must be in place in the thermometer.

B. Configure 2300A Scanner

1. If using -002 Thermocouple Scanner Cards:

   a. Attach thermocouples to the Scanner cards.

   b. Set S1 and S2 to correspond to thermocouple types in use. S1 sets thermocouple type for channels 0-4; S2 sets thermocouple type for channels 5-9. See Table 7-3 for thermocouple type selection codes.

   c. Set S3 to automatically skip any unused channels, if desired. ON = Skipped.

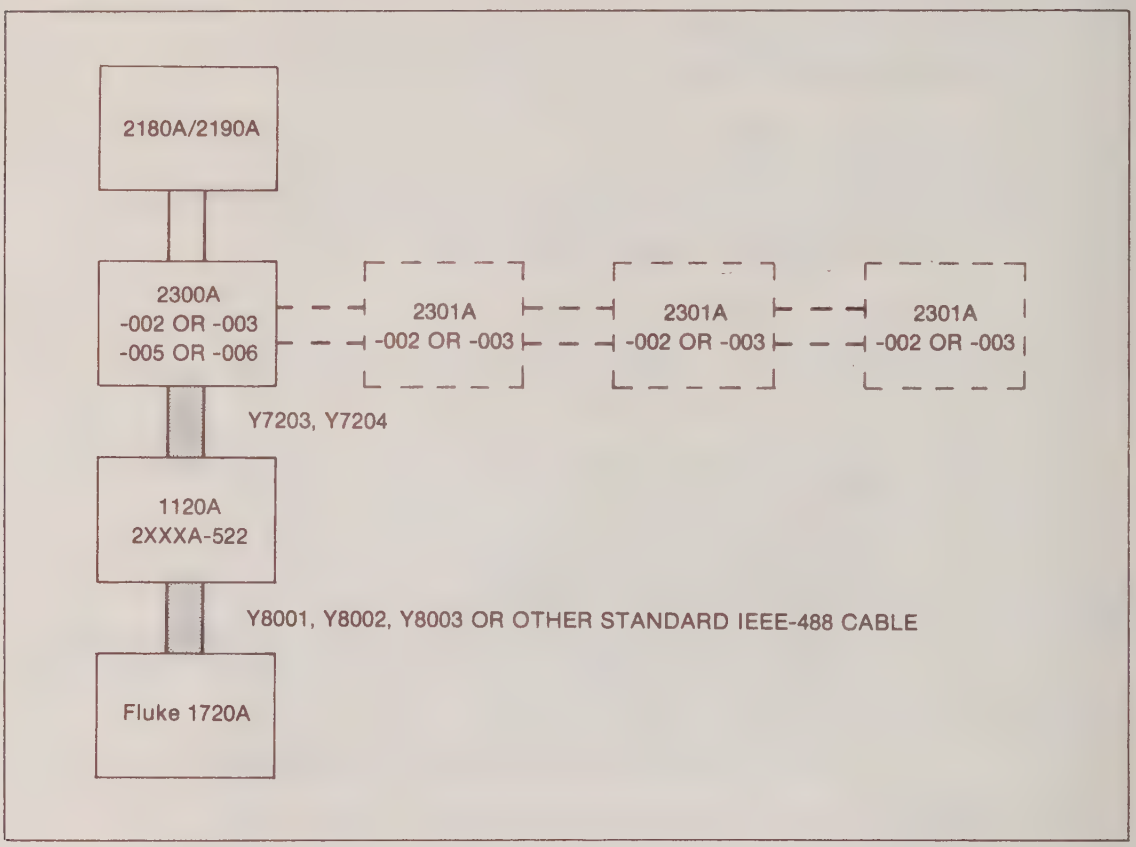
2. If using -003 RTD/OHMS Scanner Card:

   a. Attach RTD's to the Scanner cards.

   b. Set S1 and S2 to correspond to RTD types. S1 sets RTD type for channels 0-4; S2 sets type for channels 5-9. See Table 6-4 for RTD type selection codes.

   c. Set S3 to automatically skip any unused channels if desired. ON = Skipped.

Figure 18-13. Case 10: Thermometer, Scanner, 1120A, and 1720A (IEEE)



3. If using -005 Interface Option:

   a. Note: Using this interface, no remote control of the scanner is possible, and the scanner will operate in a talk ONLY mode.

   b. Set S1 (Baud Rate Select) to 2400 baud (ON OFF ON OFF). (Note: S1 is rightmost switch inside 2300A on the interface board as seen from the rear of the Scanner. To view, remove all scanner cards).

4. If using -006 Remote Control Interface Option:

   a. NOTE: Using this option, remote control of the scanner system is possible. See the programming hints in the 2300A-006 section for further information on remotely controlling the 2300A.

   b. Set S1 (Baud Rate Select) to 2400 Baud (ON OFF ON OFF). (Note: S1 is rightmost switch 2300A on the interface board as seen from the rear of the Scanner. To view, remove all the scanner cards).

C. Configure 1120A.

1. Follow instructions given in case 7, section B.

D. System Hookup.

1. Connect the grey accessory cable attached to the 2300A to the accessory connector on the thermometer.

2. If using one or more 2301A Scanner Extenders, connect the grey accessory cable from the 2301A to the 2300A, and any additional 2301A cables to the previous 2301A.

3. Attach a Y7203, Y7204, or Y7205 PTI cable from the data I/O connector on the rear of the 2300A to the input connector of the -522 card installed in the 1120A.

4. Connect the IEEE-488 bus cable Y8001, Y8002, or Y8003 to the IEEE connector on the rear of the 1120A to the 1720A's IEEE-488 input ports, Port 0 or Port 1.

E. Programming Example

```
10   Init Port 0                !Initialize port 0 (Scanner @ adr 1)
20   Print @ 1%, chr$(27);      !Send the 2300A an ESC to toggle it
30   N%=0                       !Initialize loop counter
40   R$=chr$(13)                !Carriage return <CR> character
50   !Loop 3 times to make sure ? not in queue behind data
60   Wait for SRQ               !Wait for response to the ESC
70   N%=N%+1%                   !Increment loop counter
80   Input @ 1%, A$             !Input reading from 2300A
90   If A$="?" then goto 130    !If ? then send commands
100  If N%=3 then goto 20       !If not ? & loop 3 times, send ESC
110  Goto 50                    !If not ? and not loop 3 times
120  !This portion of program sends commands to 2300A
130  Print @ 1%, "R";R$;        !Place 2300A into remote
140  Input @ 1%, A$             !Take reading to clear bus
150  Print @ 1%, "A";R$;        !Place 2300A into Auto mode
160  Input @ 1%, A$             !Take reading to clear bus
170  Print @ 1%, "D30";R$;      !Set Delay to 3.0 seconds
180  Input @ 1%, A$             !Take reading to clear bus
190  Print @ 1%, chr$(27);      !Place 2300A back into data mode
200  !This portion inputs data and prints it to screen
210  Wait for SRQ
220  Input @ 1%, A$
230  Print A$
240  Goto 210
250  End
```

J0196A-03U8307/SE EN